SCIENCE

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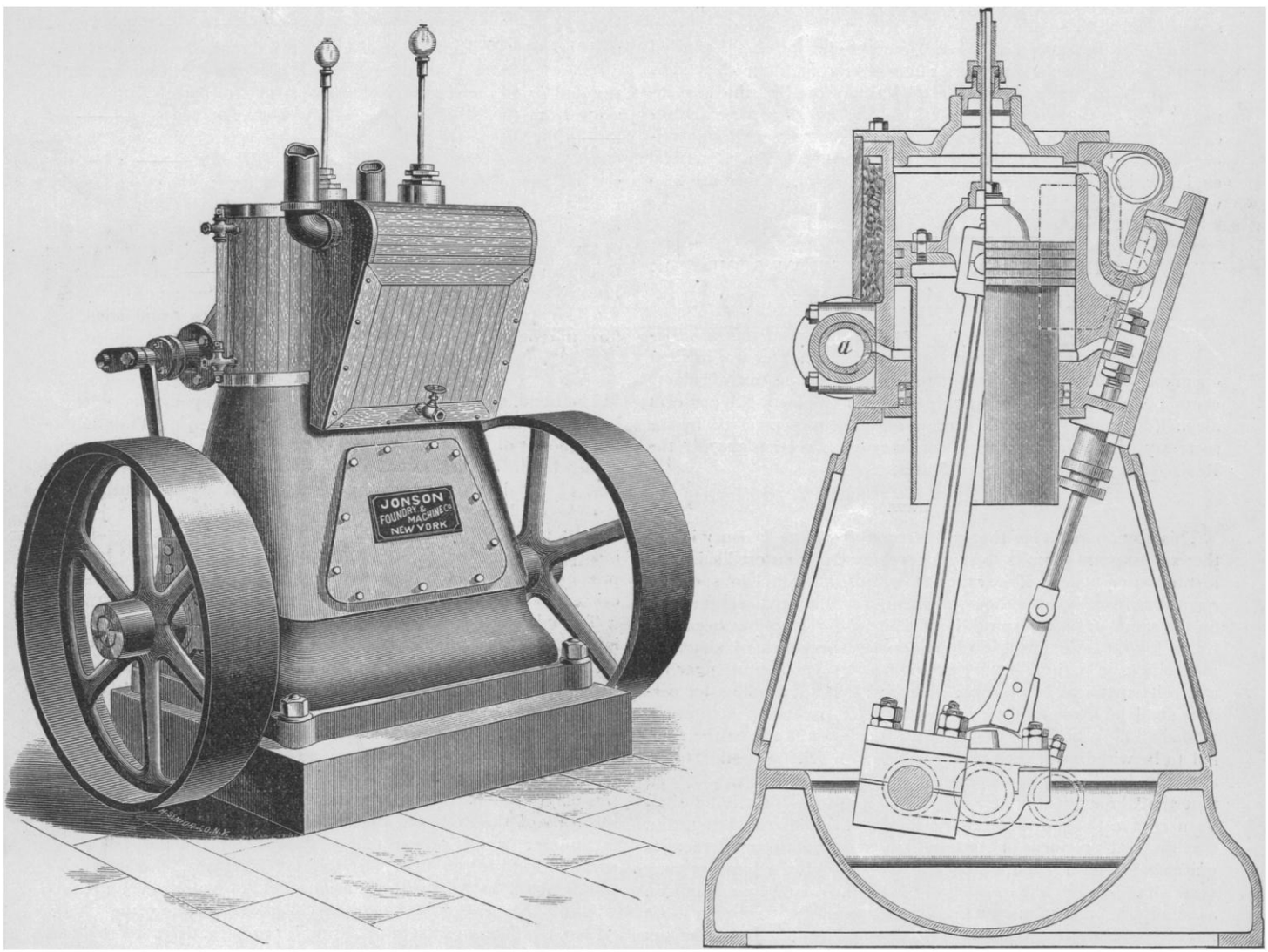
THE JONSON BALANCED COMPOUND ENGINE.

THE illustrations show a new type of balanced compound high-speed steam-engine now being introduced to the notice of steam-users by the Jonson Foundry and Machine Company of this city. In this engine there are two steam-cylinders, placed side by side, cylinder having the full area of the piston above the trunk. In the engine here illustrated the diameter of the steam-cylinder is twelve and a half inches, and the diameter of the trunk is eight and five-eighths inches, the stroke being ten inches; so that the engine has two high-pressure cylinders, each about eight inches in diameter.

In the operation of the engine, steam is admitted to the high-



THE JONSON BALANCED COMPOUND ENGINE.

the connecting-rods working in trunks, and the cranks being set at an angle of a hundred and eighty degrees with each other. All the working parts are enclosed as shown.

It will be seen that the arrangement forms a pair of half-trunk engines, the high-pressure cylinder being the annular space between the trunk and the steam-cylinder, and the low-pressure pressure cylinder for the upward stroke of the piston, and, being exhausted into the low-pressure cylinder, actuates the piston on the return stroke. For small engines, the valves of the high and the low pressure cylinders form one casting, and the steam from the high-pressure cylinder is exhausted through ports in the valve to the low-pressure cylinder. When an automatic cut-off is fitted,

an independent steam-valve for the high-pressure cylinder, shown at *a*, is added, so as to avoid damaging the action of the low-pressure valve and the high-pressure exhaust.

As an example of this practice, in an engine of 275 horse-power of this type, now being constructed for a United States steam-tender, a piston-valve is used for the steam-valve of the high-pressure cylinder, and a slide-valve for admitting the steam into the low-pressure cylinder and exhausting it therefrom. For small engines an ordinary governor, not shown in the cuts, is usually attached.

The special advantages claimed for this engine are compactness, a low centre of gravity, and particularly the fact that all the moving parts are in pairs, equal, and acting in opposite directions, thus securing a perfect mechanical balance, and adapting the engine to high rates of speed without sensible vibration.

As evidence of the adaptability of this engine for electric-lighting purposes, it may be stated that it has been attached to a thousand-light dynamo, which it ran at the rate of seven hundred and fifty revolutions per minute; and so steady was its performance, and so well was it governed, that, when the entire load was thrown off by means of a switch, it made no perceptible change in its running. The throwing on and off of such a load is a very severe test for an engine.

The following extract is taken from the report of a board of government engineers who had examined this engine with a view to determining its adaptability for the various uses of the government: "The engines are compact, and the working parts are reduced to a minimum; and they have the advantage of long connecting rods, and a reduction of height over the ordinary vertical engine with the same length of connecting rod. They are also well-balanced engines."

THE WITHDRAWAL OF ALCOHOL FROM BOND FOR SCIENTIFIC PURPOSES, FREE OF TAX.[1]

IT may not be generally known to the members of this association that they can obtain their supplies of alcohol for use in their chemical laboratories free of the internal revenue tax of ninety cents per proof gallon, or $1.70 per gallon of ninety-five per cent alcohol, by complying with certain regulations prescribed by the secretary of the treasury, in accordance with section 3297 of the Revised Statutes of the United States.

The Law.

This section provides that "the secretary of the treasury is authorized to grant permits to any incorporated or chartered scientific institution or college of learning to withdraw alcohol in specified quantities from bond without payment of the internal revenue tax on the same, or on the spirits from which the alcohol has been distilled, for the sole purpose of preserving specimens of anatomy, physiology, or natural history belonging to such institution, or for use in its chemical laboratory; *provided*, that applications for permits shall be made by the president or curator of such institution, who shall file a bond for double the amount of the tax on the alcohol to be withdrawn, with two good and sufficient sureties, to be approved by the commissioner of internal revenue, and conditioned that the whole quantity of alcohol so withdrawn from bond shall be used for the purposes above specified, and for no other, and that the said president or curator shall comply with such other requirements and regulations as the secretary of the treasury may prescribe. And if any alcohol so obtained is used by any officer, as aforesaid, of such institution, for any purposes other than those above specified, then the said officer or sureties shall pay the tax on the whole amount of alcohol withdrawn from bond, together with a like amount as a penalty in addition thereto."

The above provisions are further extended by the act, approved May 3, 1878 (20 *U. S. Stat.* 48), which provides: —

"That the secretary of the treasury is authorized to grant permits, as provided for in section thirty-two hundred and ninety-seven of the Revised Statutes of the United States passed at the first session of the Forty-third Congress, to any scientific university, or college of learning created or constituted such by any State or Territory under its laws, though not incorporated or chartered, upon the same terms and subject to the same restrictions and penalties, already provided by said section thirty-two hundred and ninety-seven: *provided further*, that the bond required thereby may be executed by any officer of such university or college, or by any other person for it, and on its behalf, with two good and sufficient sureties, upon like conditions, and to be approved as by said section is provided."

Documentary Evidence required from a Scientific Institution before it can enjoy this Privilege.

To obtain this privilege for its chemical laboratory, an incorporated or chartered, or not incorporated or not chartered, scientific institution, university, or college of learning must, at the time of its original application, clearly show, by a copy of its charter, articles of incorporation, or other documentary evidence, that it is an institution duly entitled to such permit by possessing a suitably equipped chemical laboratory and otherwise.

Form of Application.

Its application is made by the president, curator, or duly authorized agent, "through the collector of internal revenue in whose district the institution for which the withdrawal is to be made is situated," "to the secretary of the treasury for permit" "to withdraw from the distillery bonded warehouse, owned by ———, at ———, in the ——— district of ———, the alcohol which was stored in said warehouse on the ——— day of ———, 18—, described as follows: viz., number of packages; marks and serial numbers of packages; numbers of warehouse-stamps; wine-gallons; degree of proof; proof-gallons; taxable gallons; and amount of tax; for the *sole purpose* of use in the chemical laboratory of the institution, located at ———, in the State of ———, of which institution" the signer is one of the persons above mentioned.

"The application in all cases must be sworn to, or affirmed, before an officer authorized to administer oaths."

Character of the Bond.

The bond, required to be filed with the first application, must be in a penal sum of "not less than $200, and never less than double the amount of tax on the alcohol withdrawn at any one time," is signed by the applicant "as principal, and with two or more sureties, who shall not be officers of the institution in which the alcohol is to be used, but shall be residents of the United States judicial district in which such institution is located." In the case of "an incorporated institution, its name should be signed to the bond as principal, and its corporate seal affixed by its duly authorized officer, who should also sign his own name as such officer."

The bond is conditioned that "the entire quantity of alcohol" intended to be withdrawn "from distillery warehouse, without payment of tax," by the said principal, will be "for the sole purpose of use in the chemical laboratory of the" said institution, "in the city or town of ———, of the county or parish of ———, and State of ———," "and for no other purpose."

The bond is known as a "continuing bond;" i.e., "withdrawals may be made from time to time," "by the said principal," "until this bond shall have been revoked or cancelled by direction of the secretary of the treasury," of certain alcohol for use "by the said institution, or the proper officer thereof, for the purpose above specified, and for no other purpose." "The principal of said institution shall, as to each lot of alcohol so withdrawn, produce within" the time "fixed by the collector accepting the bond," "from the date of such withdrawal," "proof satisfactory to" the collector of internal revenue of that district, "and to the commissioner of internal revenue, that the said alcohol has been so used for the purpose above specified, and for no other purpose." He shall also "comply with such other requirements and regulations as the secretary of the treasury may prescribe;" and according to the last paragraph of section 3297, Revised Statutes, "the said officer or sureties" are bound by this bond to pay to the collector "the tax on the whole amount of alcohol withdrawn from bond, together with a like amount as a penalty in addition thereto," "in case said

[1] Paper read before the Association of Official Agricultural Chemists at Washington, D C., Sept. 11, 1889.

alcohol, or any part thereof, shall be used for any purpose other than that specified."

Bond and Application to be filed with the Collector for Approval.

The "bond, together with the first application for permit, will be deposited by the applicant with the collector of internal revenue for the district where the institution in which the alcohol is to be used is located." It is the collector's duty to forward the bond and application to the commissioner of internal revenue, with his certificate of approval, etc. He keeps "a copy of the bond, or a memorandum of its date, penal sum, and the names of the signers; and whenever an application for alcohol is made after the first one, the collector will certify to the commissioner of internal revenue that the bond remains good, or will notify him of any change affecting the responsibility of the signers." "Upon the approval of the bond by the commissioner of internal revenue," applications may be made on the prescribed form "for the withdrawal of alcohol as occasion may require" by the duly authorized officer or agent: "*provided*, the penal sum of the bond is equal to double the amount of tax on the alcohol to be withdrawn, after deducting all outstanding charges on the bond." The commissioner transmits the applications "to the secretary of the treasury, with a notification of the approval of the bond when the first application is forwarded, and afterwards with a reference to the bond under which the application is made."

Cancellation of Bond.

To cancel the bond "or for the purpose of obtaining a credit on said bond," a sworn certificate is "required of the officer or officers of the institution under whose direction or supervision the alcohol has been used." The certificate is "filed with the collector named in the bond, and if approved, to be forwarded by him to the commissioner of internal revenue with his approval indorsed thereon."

Extension of Time named in Bond.

It sometimes happens that the alcohol is not entirely used up in the time specified in the bond, and that consequently "the principal to the bond is unable, for good cause, to furnish the required proof" of such use. He may obtain an extension of the time named in the bond upon application to the commissioner of internal revenue, "accompanied by the consent of the sureties to the bond to such extension; such application and consent to be approved by the collector with whom the bond was originally filed." "The extension asked for must be for a specified time," "not exceeding one-half the period named in the bond." The application "must be sworn to," and state "the reasons why the conditions of the bond as to the presentation of proof have not been complied with." The consent of the sureties must be "under seal, and witnessed as in the case of giving an original bond."

Permits to be issued by the Secretary of the Treasury.

"The secretary of the treasury will issue," "upon receipt of the application" "and notice of the approval of the bond," "and transmit through the commissioner of internal revenue, a permit in duplicate, one copy of which will be forwarded to the applicant and the other copy to the collector of internal revenue for the district in which the distillery warehouse is located," to withdraw from the specified warehouse the number of proof gallons of alcohol described in said application.

The collector notifies "the storekeeper at the bonded warehouse from which the spirits are to be withdrawn" of the receipt of the permit, a copy of which is sent to him, and authorizes him "to deliver the spirits to the person named therein, or his duly-authorized agent, without the payment of tax, upon delivery to such storekeeper and cancellation by him of the duplicate permit issued to such person." This "cancellation shall be made by writing across the face of said duplicate permit the words 'The spirits herein described were delivered to the person herein named this ——— day of ———, 18—;' to be signed by the storekeeper." "There shall also be indorsed on the back of said permit the following receipt: 'Received the spirits within mentioned this ——— day of ———, 18—,' which receipt shall be signed by the person named in said permit."

Such in detail are the steps to be followed as prescribed by the regulations of the secretary of the treasury under date of March 26, 1889.

Blank forms are not furnished by the Treasury Department; and such forms, either printed or written, must be supplied by the parties making the application and bond. The forms to be followed are contained in Circular No. 34, 1889, of March 26, 1889, Treasury Department.

Are Agricultural Experiment Stations entitled to this Privilege?

The laws, quoted above, restrict this privilege of the withdrawal of alcohol free of tax to four specified beneficiaries: viz., (1) "any scientific institution" or (2) "college of learning," "incorporated or chartered;" (3) "any scientific university" or (4) "college of learning" "created and constituted such by any State or Territory under its laws, though not incorporated or chartered;" which are further qualified as using alcohol (*a*) to preserve specimens of anatomy, (*b*) physiology, or (*c*) natural history, or (*d*) to be employed in its chemical laboratory. With the latter qualification the members of this association are chiefly concerned.

The act, approved March 2, 1887, "to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July 2, 1862, and of the acts supplementary thereto" (24 *U. S. Stat.* 440), commonly called the "Hatch bill," provides in section 8 that these "agricultural experiment stations established by law" may or may not be "in connection with any university, college, or institution not distinctly an agricultural college or school," or may or may not be "separate from" "colleges entitled" "to the benefits of this act;" i.e., land-grant agricultural colleges.

Section 2 provides "that it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on . . . the chemical composition of useful plants at their different stages of growth; . . . the analysis of soils and water; the chemical composition of manures, natural or artificial; with experiments designated to test their comparative effects on crops of different kinds; . . . the value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific . . . questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories."

These experiments evidently require a well-equipped chemical laboratory, in which alcohol would be often used as a solvent and re-agent in addition to any use of it as a fuel in the laboratory.

Taking the above quoted qualifications and provisions of law into consideration, it would seem that any agricultural experiment station that is established in conformity to the provisions of the act of March 2, 1887, by any State or Territory as such, when such station is connected with a "university or college of learning," is entitled on presentation, by its duly authorized officer or agent, of documentary evidence to that effect submitted to the secretary of the treasury through the commissioner of internal revenue and the collector of internal revenue of the district in which the experiment station is situated, and by filing a bond and otherwise conforming to the regulations, above specified, to the privilege of withdrawing alcohol, free of tax, for use in its chemical laboratory; also that when the experiment is not connected with a college, etc., it may obtain free alcohol under the same regulations, provided it is shown to the satisfaction of the internal revenue officers and the secretary of the treasury that it is of itself a "scientific institution" as construed by those officers, that is, such an institution whose object is educational.

EDGAR RICHARDS.

WHEN an electric current, says a French contemporary, is led through the leaf of a rose, the leaf loses its color, leaving a white line. This peculiarity was recently turned to account at a great dinner in Paris, when, instead of the ordinary card, the seat of each guest was indicated by his name being inscribed in white letters upon a rose-leaf in his *couvert*.

ELECTRICAL NEWS.

THE TELEGRAPHONE. — A problem heretofore only partially and unsatisfactorily solved is the registration of telephonic messages so that they can be received at pleasure. Most of the efforts in the direction of its solution have been towards using the induced currents from the Blake transmitter in producing a record on the phonograph at the other end of the line. An amplifying trumpet has been used, and the vibrations of the diaphragm of the receiving instrument have been recorded on the cylinder of the phonograph. It has thus far been necessary that an operator should be at both ends of the line, and any slight electrical disturbances that would interfere with the delicate induced currents naturally have blurred the phonographic record. An instrument has lately been patented and brought out that will no doubt be of actual use and commercial value. It is called the "telegraphone," and is the invention of Mr. Malone Wheless of Washington, D.C. Mr. Wheless does not depend upon the transmitter currents for his impressions: the speaker's voice is registered on the cylinder mechanically, the record being of the nature of dots and dashes on a strip of paper. A stylus connected with a light primary battery moves along these impressions, producing current interruptions of a make-and-break character, almost similar to the Morse code, and reproducing the impressions on the registering cylinder at the other end of the line. In practice, if A desires to send a telephonic message to B, who is not at home, he calls him up in the usual way. Receiving no answer, he turns a switch which throws in the battery power and sets the cylinder at the other end in operation. He then talks into his transmitter. The vibrations are transferred to the cylinder, and the stylus sets up a series of waves, reproducing the impressions at the other end, and registering the message. A then reverses his switch, and the message is repeated back to him. Should any part of the message be inaudible, he simply fills in the blurred words or sentences, and the record at the other end is then satisfactory and complete. Upon B's arrival home, he finds the message waiting for him, corrections and all; and if its importance demands it, he can have it repeated to himself as many times as he chooses. The inventor claims that the apparatus can be manufactured and sold outright at a very low figure, and it is difficult to foretell whether its usefulness or novelty will be the most interesting feature.

ELECTRICAL EXECUTIONS. — This subject will enjoy popular interest as long as the law now supposed to be in force remains upon the statute books of the State of New York. It seems to have been adopted for the reason that those having the matter in hand knew less about death from electricity than from any other cause, and also because the expert advice at hand seems to have been discolored with the tainted aniline of business jealousy. The subject, from a scientific standpoint, is of itself sufficiently interesting and baffling; but when the people realize, as they now must, that the enactment of the law was due largely to the influence of a party whose object was not so much to furnish a quick and painless death as to enrich himself, it causes a cold shiver of horror to pass over the community. Exactly how many volts of electrical pressure will kill is as uncertain as would be the number and force of the strokes from a club that would produce death. A number of persons, among whom may be mentioned Mr. T. Carpenter Smith, the well-known electrical engineer, have been accidentally subjected to the action of the very type of machine intended to be used by the authorities, and have lived. Other persons have died instantly from a much lighter shock. Only a few days ago expert Henry of this city was instantly killed by 1,000 volts. Since that time a Buffalo lineman lived in agony for forty minutes after suffering the enormous pressure of 2,000 volts. Will electricity kill? Certainly it will kill, but exactly how applied, and how many volts?

ENCROACHMENT OF ELECTRICITY UPON GAS IN HOUSE-LIGHTING. — Gas, which is now almost universally employed, has not come into use in a moment. The difficulties attending its distribution at great distances from the source of supply have never called for more than mechanical skill and ingenuity. But with electrical distribution the problem to be solved is not how to cover a certain territory with the mains and feeders of an electric-light system, but how to do it with a fair profit on the investment. Among the methods making rapid strides is that of the distribution of electricity by means of the alternating current. The very type of machine which the authorities consider so dangerous to life will no doubt be that which will eventually solve the problem of universal electric house-lighting. The current in the outside mains is of a high pressure, — 1,000 volts or more, as the case may be. This current is transformed by means of the converter to a lower potential, and carried into houses at the safe and low pressure of only 50 or 100 volts. More and more private residences are being wired for and lighted by electricity every day, and this is the case more especially in small and growing towns than it is in large cities. Little towns like Marshall, Tex., Vicksburg, Miss., and the small towns of the Far West, are falling into line, and availing themselves of every fresh improvement that will increase the returns from investment and enhance the worth and reliability of the light itself. In the New England States this condition of things to-day obtains to such an extent that nearly every week finds some gas company absorbing the local electric-light company out of pure self-defence, and continuing the work.

AMERICAN ELECTRICAL ENTERPRISE IN LONDON. — The increased and increasing investment of English capital in American institutions has caused much comment. American capital is not doing precisely the same thing in England, but the establishment of a Westinghouse Electric Manufacturing Company in London is a fact that must excite comment and admiration as well. The Westinghouse Electric Company of London has been organized with a capital of $3,000,000. The factory is to be located on York Road, adjoining the Westinghouse Air Brake Works. Other electric companies are extending themselves abroad, but this is one of the most striking and recent examples of such extension.

ELECTRIC TANNING. — It is now claimed that an electrical process for tanning hides has been devised which reduces the time of the operation from six months or a year to twenty-four hours, turning out leather of equal quality. The cost is said to be reduced more than one-half. It is usually the case with quick processes that the material so turned out is in many respects inferior to that manufactured in the usual way by skilled workmen who have taken advantage of the experience of others, and perfected their process after years of work and study. The new system alluded to does not partake in any way of the nature of an "electric sugar" concern, as each step has been made public and carefully described. When it is proved that the leather thus turned out is equal in all respects to that now manufactured, the process will possess more interest than its shadowy entity now elicits.

ELECTRIC SIGNALLING FROM SHIPS. — If there is any thing in our naval service that is inefficient and undeveloped, it is the system known as "wigwag" signalling. A flag with a short staff is waved to the right and left a given number of times for each letter of the alphabet according to the code, and the speed attained is remarkable for its slowness. Lack of speed can also be attributed to insufficient practice of those using the code, although the exercises enforced on board most vessels have given rise to a number of bright, quick signalmen among the apprentice boys who do the service proud in this respect. But with the most expert signalmen the speed attained is so unsatisfactory that a quicker method will no doubt before long come into use. Where vessels are fitted up with electric lights, a system of signals is sometimes employed, extending the use of the "wigwag" code to two incandescent lamps suspended somewhere in the rigging for night work. In such cases a double key is used, the illumination of one lamp being read "one," and of both lamps at the same instant, "two;" the letters of the alphabet being represented by combinations of "one and two." Although these flashes can be made much faster than the motions of the flag in daylight, still it is so easy to exceed the possible speed of the reader on the other vessel or on shore, that little increase of efficiency is attained. It takes but two or three months to become tolerably proficient in the use of the ordinary key and sounder, reading from fifteen to twenty words per minute at least. The same device that now flashes out the clumsy naval code could be employed in connection with the Morse alphabet with a great saving of time. Practice in taking from a telegraph instrument makes the ear or eye practically drink in the words spelled

out, without a conscious analysis of individual letters. Messages can be flashed from the rigging of ships with almost the rapidity of telegraph messages over ordinary wires. Take, for example, the message "The uniform of the day will be clean blue." This sentence of only nine words, if sent at the rate of nine words per minute according to the regular navy code, could be read by about one officer out of ten. Few officers can read that fast. The average speed of signalling, then, by the "wigwag" system is probably less than nine words per minute. It ought to be more. Mr. Edison has suggested an adaptation of his train telegraph system to the use of ships at sea. If a sufficient area of insulated metallic surface could be exposed somewhere, either on deck or aloft, it might be possible to telegraph from ship to ship by electrical induction without the use of connecting wires, just as Edison in a moving train takes messages from the wires along the track. We know of no experiments in this direction as yet, but the field is certainly an interesting and promising one.

AN ELECTRIC LOCOMOTIVE. — Will trains eventually be run by electricity? The electrician is met by this question almost daily, and his only reply is that they will if the problem of their commercial success be finally solved. Of course, running machinery of any kind from primary batteries is commercially out of the question. Every one with even the most rudimentary knowledge of the science realizes that it takes a certain consumption of zinc or other metal to liberate a certain amount of energy, and that this method is altogether too expensive to be practicable. However, there is now being constructed at the locomotive works, Rome, N.Y., an electric locomotive which is the first engine, we believe, attempted to be run on regular railroad-tracks from storage-batteries. The ordinary rotary type of electric motor will not be employed. Suction-magnets are to be located on either side of the piston, and the current supplied from storage-batteries in the fire-box. The locomotive is smaller than the usual type, and has driving-wheels of less diameter. In a few days the trial trip will be made, and *Science* will give its readers the result. The question will be asked, "How is it possible to utilize the energy of storage-batteries at such a great loss from the original energy of coal, and still be as economical as the steam locomotive?" That is the fact that remains to be proved. It should be remembered, however, that it may be possible to generate electricity by means of large economical compound condensing engines with a final loss at the motor not much greater than that which is found in that great wasteful gormandizer of coal, the steam locomotive.

NOTES AND NEWS.

THE Rev. Mr. Frizelle of Bushmills, England, narrates, in *Science Gossip*, that he witnessed a trial of a rook by his comrades for the act of stealing sticks from other nests. The other rooks assembled round the culprit, and cawed for a considerable time, when the unfortunate bird was condemned to suffer the penalty, and he was then and there set upon and pecked to death. Two magpies were present, who appeared seemingly as witnesses.

— The University of Jena is going to hold autumn courses for teachers in the various sciences. The course, commencing Sept. 23, is to last a fortnight, and comprises the following subjects: psychological principles of education, instruction in chemical experiments, the same in physical science, botanical observations and morpho-physiological experiments, animal biology, school hygiene, physical geography, and colonization.

— Any one who takes a walk abroad in the rural parts of France, when farming operations are going on, says J. W. Slater in *Science Gossip*, will often see small children following the plough armed with small pitchers, into which they put all the white, fat grubs of the cockchafer which are turned up. In England the rooks do this work, without young children being withdrawn from school or from play. But the French sportsman has nearly extirpated these useful birds. A recent iniquity, according to a contemporary, is the systematic destruction of the swallows on their return from Africa. Emissaries of the Paris *modistes* fix up on the shore, about the points where the birds usually land, long wires connected with powerful electric machines. The wearied swallows perch on the wires, and are struck dead by scores. Their bodies are then sent off to Paris to ornament women who are a disgrace to humanity. The saddest feature is that our contingent of martins and swallows arrive by way of France, and will doubtless be cruelly decimated.

— Professor Beal finds that the peculiar markings in bird's-eye maple do not occur in young trees up to about three inches in diameter, nor very high up in trees which are very much pitted at the base. A specimen taken fifty feet above the ground, *Garden and Forest* states, showed no trace of bird's-eye, while another from near the base of the same tree was very strongly marked. If the cause of these formations could be discovered and used to produce the marks, it would add greatly to the market value of the timber, for the wood of this maple and of other trees somewhat similarly marked is comparatively scarce and in great demand for veneers.

— F. W. Galton, the famous writer on the subject of inherited qualities, proposed to the Congress of Psychological Physiology to issue in the form of a document a series of questions intended to draw from scientific observers the world over the results of their experience touching the inheritance of acquired habits, mental, scientific, or social. He laid before the congress a first-rate conundrum. He told of an aquarium divided into two parts by a plate of glass perfectly transparent, and therefore invisible to the fish. In one division there was a pike, in the other a gudgeon. Every time the pike saw the gudgeon, he rushed to seize him, but every time he was stopped by the plate of glass. He did not learn soon, but for several months made this rush, and bruised his nose against the glass. Finally he came to understand that for some reason inscrutable to his intelligence he could not seize the gudgeon, and then he gave it up. He now swam about, seeing the gudgeon constantly, but paying no attention to it. Then the plate of glass was removed. This made no difference, the pike did not attempt to take the gudgeon. He had acquired the habit of leaving the gudgeon alone. The conundrum was, would his descendants inherit that habit, or possess the original impulse of their kind? Illustrations of this kind, or showing the operation of the principle of acquired inheritance, are what Mr. Galton wants.

— The great chart of France, showing the geological formations of the country on a scale of 1:500,000, has at length been completed, and a copy deposited with the Academy of Sciences at Paris. It is over fifty years since MM. Dufrenoy and Elie de Beaumont published a geological map of France on the same scale, and since that period the rocks of the different provinces have been more intimately studied. In 1882 the new general map was begun under the superintendence of the Commandant Prudent, and published by the depot of fortifications. It has just been finished, and, according to the *Scottish Geographical Magazine*, is an example of the most accurate cartography. Local geologists have contributed to the work as well as the government surveyors, and the scale of 1:500,000 has been adopted in deference to the wish expressed at the geological congress of Bologna in 1881, so that different countries can more easily compare the map with their own. The scale of colors recommended at that congress has also been followed,— that is to say, the sedimentary series is represented by the colors of the spectrum in their regular order. Thus the trias is colored violet, the Jurassic blue, the cretaceous green, and the tertiary yellow. Each of these general colors is subdivided into shades, which are deeper according as the rocks are more ancient. This is the first time the method has been employed on a large work, and it has given every satisfaction, since it allows the systems of rocks and their different gradations to be readily recognized. The eruptive rocks have been colored in different shades of red, and the crystalline schists in carmine. As for the primary rocks, on which the congress came to no decision, the authors of the map have been guided by the same principles in choosing their tints. The Silurian has therefore been colored a flesh pink, and the Devonian a red brown. The carboniferous, according to old habit, has been colored black and deep gray, while the Permian is represented by a yellowish gray. No fewer than fifty shades are employed; but all are easy to distinguish.

— The number of students attending the principal German universities amounts to 29,491, of whom 6,060 study theology, 6,835 law, 8,883 medicine, and 7,713 philosophy and natural sciences. It is of interest to know that 314 of these are Russians.

— A commission representing the various German railway companies has published a report detailing the results of observations made during six years on the durability of steel rails on their lines. According to this report, it appears that the duration of a steel rail may be reckoned on an average at thirty-five years.

— The Prussian minister of education is turning his attention towards the study of the history of medicine, which seems to have been slowly dying out. There used to be a chair for this subject at every German university, but they have all become vacant with the exception of the one at Berlin, occupied by Professor Hirsch, the Nestor of the historians of medicine. To counteract this, it has been ordained that every newly appointed professor of hygiene should give lectures on the history of medicine as part of his work.

— The American Public Health Association will hold its next annual meeting at Brooklyn, N.Y., Oct. 22–25, 1889. This association comprises over eight hundred members, all devoted, officially or otherwise, to its declared purpose, the advancement of sanitary science and the promotion of organizations and measures for the practical application of public hygiene. In the furtherance of this purpose it has met annually, during the last sixteen years, in different cities of the United States and Canada, and has in every instance had the effect of greatly stimulating public effort in the promotion of health and measures for its maintenance. With the hope of still further magnifying this interest and effort, it is the purpose of the association, through its local committee, at the forthcoming meeting, to provide an exhibition of every thing available adapted to the promotion of health. The exhibits will be classified as follows: Division I. The Dwelling, including models and designs for sanitary dwellings; foundations, drainage, drainage tiles, etc.; bricks, tiles, floors, cements, etc; devices and appliances for furnaces, stoves, water and steam-heating apparatus; ventilation and lighting; domestic water supply, purification, filters, water fittings, etc.; traps, sinks, water-closets, baths, etc.; domestic garbage destructors, garbage receptacles, etc.; and sanitary furniture, refrigerators, wall-paper (non-arsenical), floor coverings, etc. Division II. Schools and Education, including plans and models for improved school buildings; heating, ventilation, lighting; furniture and fittings; improved books, printing, etc.; gymnastic apparatus; and works on sanitary topics. Division III. Factories and Workshops, including designs and models for improvements in factories and workshops, life and health saving devices, and special devices for removing dust and effluvia and preventing injuries from them. Division IV. Clothing and Dress, including improved materials and garments, etc. Division V. Food, including selected displays of unprepared animal and vegetable substances used as food or in the preparation of food; prepared vegetable substances used as food, including canned and prepared, and preserved fruits and vegetables, prepared cereals, meals, flour, biscuits, bread, etc., and sirups, sugars, etc.; canned, smoked, salted, preserved, and prepared animal foods; products of the dairy; alcoholic and non-alcoholic beverages, tea, coffee, cocoa, chocolate, etc.; food for infants and invalids; articles and devices used in the preparation of food; cooking-stoves, ranges, etc.; vessels for preserving food, etc.; adulterants and adulteration. Division VI. Sanitary Engineering, including plans for sewerage and sewage disposal, plans for drainage, plans for water supply, purification, filtration, etc. Division VII. Public Health Administration in Cities and Towns, including treatment of contagious diseases; plans for hospitals; vital statistics, blanks, etc.; disposal of waste, garbage destructors, odorless apparatus; antiseptics, disinfectants, and disinfection; and reports of local and State boards of health. Division VIII. The Laboratory, including instruments of precision in meteorology, thermometers, barometers, hygrometers, etc.; general chemical apparatus for health laboratory; microscopes, etc.; biological apparatus, cultures, etc. Division IX. Red Cross Section. The exhibition will be held in the hall at the north-west corner of Fulton and Pineapple Streets, one block from the Brooklyn Institute, where the sessions of the association will be held, and but three blocks from the bridge. It will be opened to the public on Oct. 22, at 1 P.M., and will continue open until Dec. 1. Admission free. Applications for space may be made to any member of the committee on exhibits, accompanied with details as to name and character of articles proposed, space required, and the name and address of applicant. To cover the necessary expenses of the exhibition, each exhibiter will be charged ten dollars, allowing him twenty square feet of floor space, and thirty cents per square foot for additional space, to be paid on the second day of the exhibition. All proposals for exhibition and applications for space are subject to the approval of the committee on exhibits, and should therefore be made as promptly as practicable. At the close of the exhibition the association will award diplomas to exhibiters of specially meritorious articles, based upon the judgment of experts. E. H. Bartley, M.D., of 21 Lafayette Avenue, Brooklyn, is the secretary of the association, and J. H. Raymond, M.D., 173 Joralemon Street, is chairman of the executive committee.

— The *Russian Gazette* has received some disturbing intelligence on the subject of the rivers of Russia, which play such an important part in the internal communication of the country. The Dnieper has become so shallow that navigation is difficult at even the deepest parts, such as between Kiew and Catherinoslaw. Small boats can only pass now where vessels sailed formerly. The Volga itself is not much better, and the river steamers are unable to reach Nijni Novgorod. In consequence of these facts, a strenuous measure of river-dredging and stricter regulation for the control of the navigation of the greater rivers, such as the Don, the Dnieper, and the Volga, is being advocated, and it is believed that the minister of ways of communication has the subject under his serious consideration.

— An instance of the progress made in electro-technical science is furnished by the installation just completed for lighting and transmission of power in the south of France at the neighboring towns of Dieulefit and Valréas, situated twenty-one kilometres apart, and having their common electrical source of supply at Béconnes, situated fifteen kilometres from Valréas, and six kilometres from Dieulefit. The supply of electrical power, according to the London *Electrical Review*, is excellent in both places. The lighting installation has been effected by an electrical firm in Lyons, and the apparatus manufactured by the Edison Company of Paris. The motive power is water, of which some three hundred horse-power are at disposal, but as yet only a part is required. In Switzerland, too, two waterfalls are to be used as motive power for transmission of electricity, namely, at Klus, on the river Aar, and at Lartze, by a company from Zurich. At the Hotel Bernina, at Samarten, in the Engadine, which has for some time been lighted by electricity furnished by a neighboring waterfall, the proprietor has hit upon the ingenious idea of utilizing for cooking the force wasted in the day. Other experimental cooking apparatus has been constructed, containing german-silver resistance coils, which are brought to red heat by the electric current, and all the ordinary cooking is now being done in a range fitted with a number of these coils.

— The commissioner of agriculture of Texas, in his first annual report, presents a statement of the aggregate cotton crop of that State for 1887 by counties. In many parts of the State the season was an unfavorable one for this crop, drought and worms very much reducing the yield per acre. An estimate of the damage done by worms, compiled from the first annual report of the commissioner of agriculture of Texas, by Mr. B. W. Snow, assistant statistician to the department, is presented for each county, ranging from nothing in many counties to a loss of fifty per cent of the crop in others of large production, and an even heavier loss in some counties where the crop is of little importance and insecticides are not made use of. For the whole State the amount of damage done averaged about twenty-one per cent of the crop. According to this return, the total number of bales gathered was 1,125,499, while, had there been total exemption from insect damage, the farmers of Texas would have gathered a crop of 1,422,948 bales. This would make the aggregate loss from worms equal to 297,449 bales. The value per bale of the crop which was made at the place of production averaged slightly over forty dollars. Pre-

suming that an increase of less than half a million bales in the aggregate crop would have made but little difference in price, the actual money loss to the farmers of Texas in one year from the cotton worm alone was $11,897,960. It is not claimed that these figures are absolutely accurate, but they are undoubtedly approximately correct, and will give some idea of the enormous tribute levied upon American agriculture by injurious insects. In that year Texas produced but twenty-one per cent of the cotton crop of the country, and the cotton caterpillar and boll worm were active in all sections of the cotton belt. The injury elsewhere may not have been so heavy, but it would swell the aggregate loss in one crop to startling proportions.

— The harsh measures adopted by the Russian Government towards the extirpation of German educational landmarks in the Russian Baltic provinces, have been recorded from time to time. There are now two more such ukases to chronicle. The first and vitally important one is the closing of the Deutsche Lehrerseminar in Dorpat, which has existed for over sixty years, and served the purpose of training teachers for the elementary schools in the Baltic towns. The institution had been developing great usefulness during the last twenty-five years especially. The other ukase forbids the working of the Evangelical-Lutheran Society, which had lately been founded for charitable purposes.

— The French Government has made Professor C. V. Riley a chevalier of the Legion of Honor, as a deserved compliment for his effective studies in economical entomology. His researches have not only been of advantage to the farmers and fruit-growers of the United States, says *Garden and Forest*, but he discovered that the phylloxera was an American insect, and identical with the pest which had proved so disastrous to French vineyards. He also introduced into France the spraying-nozzle which bears his name, and which, with certain modifications, is used in that country to counteract the mildew of the vine.

— Dr. Eduard Bodemann of Hanover has just published the correspondence of Leibnitz, which until now had lain buried in the Royal Library of that town. The author gives a minute description of this great literary treasure, the value of which will be easily understood from the fact that more than 153,000 letters had to be perused and edited, and that the number of persons, scholars, statesmen, and royal personages with whom Leibnitz corresponded amounts to 1,028.

— The commission appointed to inquire into the scheme for making Paris a seaport has now issued its report. In this it is stated that the canal is of a nature to increase the commercial activity of France by bringing Paris into more direct communication with the great producing centres, and would in particular enable the city to compete with Antwerp, the commerce of which, it is said, is increasing year by year, to the detriment of French ports. No insuperable engineering difficulties are to be encountered, and even taking the most pessimistic estimate of the cost, viz., 200,000,000 francs, it is believed that the traffic would be sufficient from the very commencement to earn interest on this. French estimates of the expenses of canal construction will, however, be received with some caution after the gigantic fiasco of Panama. Proceeding, the report goes on to say that the heavy sacrifices made by France in the past few years have not succeeded in meeting the competition of Antwerp, the trade of which has risen in a few years from 1,000,000 to 7,000,000 tons, and affirms that the only chance of doing so now is by rendering Paris accessible to sea-going vessels. It is further stated that in the event of another war it would be impossible to starve out Paris, as in 1871, were the canal made; though it is not easy to see the grounds of this statement, as one would think that the canal could be blocked without much difficulty. The canal would be 180 kilometres long; and a depth of 6.2 metres is proposed for the channel, the breadth of which at the bottom should be half as wide again as at Suez. The spoil from the excavation could, it is said, be advantageously disposed of in raising the level of some low-lying lands along the banks of the Seine. Whether the work will be undertaken by the government remains to be seen; but it is, on the whole, unlikely, as the engineers of the Seine are said to be opposed to the scheme; and, if the government do not take it up, no other body in France will, of that we may be certain.

— School-gardens, i.e., gardens for practical instruction in rearing trees, vegetables, and fruit, are being added to nearly all the public and private schools of Austria. There are now already 7,769 such in existence in the Austrian monarchy alone, Hungary not included. They also comprise botanical museums, and appliances for bee-keeping.

— We learn from *Nature* that a report on the appearance of the Hessian-fly in England, by Mr. Charles Whitehead, the agricultural adviser, has been issued by the Agricultural Department of the Privy Council. The fly was first seen in 1886 in Great Britain, and in that year did some harm to wheat and barley plants in England and Scotland. In 1887 it was noticed in twenty counties in England and ten in Scotland, wheat and barley crops being considerably damaged by its action. The weather during the summer of 1887 was hot and dry, like that which normally prevails in America, and was presumably favorable to the development and progress of the fly. During 1888, when the summer was unusually wet and cold, very little was heard or seen of the Hessian-fly either in England or Scotland; but during the early months of the present year the temperature was high and the rainfall small, and, from the reports received by the Agricultural Department, the infested area has largely increased in England. In Scotland it does not appear to have made so much progress, still it is present in many Scotch counties. The actual amount of injury to the crops is slight, and, so far as can be ascertained, is not in any instance so important as that caused in some cases in 1887. It is most probable that the injurious operations of the insect have been checked by the wet, cold weather which has followed the abnormal heat of May, and the warmth and dryness of June. When a cycle of hot summers occurs, it may happen that the ravages of the Hessian-fly may be general and calamitous. Mr. Whitehead therefore urges the desirability of careful watching, and the prompt adoption of simple methods, which he describes, for preventing the increase of the pest.

— In his last report, the British vice-consul at Nisch mentions the terrible havoc which is being made by disafforestation in Servia since its independence. He says that during the Turkish occupation Servia was covered with magnificent forests of oak, beech, chestnut, and walnut trees, by means of which the country was assured of a regular and plentiful supply of water, and in the recesses of which the natives found shelter, and refuge from their foreign conquerors. From the date of her independence a destruction of these invaluable treasures commenced which has been carried on with remorseless and unreflecting perseverance, and it appears as though there were at the present day a race against time to complete the havoc. From time to time the consciences of ministers and governments have roused them to interfere; but, beyond passing laws which remain a dead letter, hardly any thing has been done to arrest the evil. Floods in winter, and drought in summer, were declared by Mr. Borchgrave, in 1883, to have already begun to exact the penalty which carelessness or want of foresight must be called upon to pay; but the peasant and his goats continue their work of destruction, while the authorities are apparently more anxious to avoid occasions of discontent which restrictive measures would create than of applying such remedies as legislation has placed in their hands. Whole mountains may be seen completely denuded of timber, with the exception of a low worthless scrub, which were, a few years ago, covered with woods, but which have fallen victims to the innumerable herds of goats which are allowed to browse at will. The peasants among whom the land was divided at the time of the Servian independence have cleared vast tracts for the purposes of agriculture, and possess the right of cutting timber for firewood in those forests which are under the management of the different communes. Very little coal is used for household purposes, and the amount of wood required for daily consumption adds enormously to the drain on the national resources. The best-wooded parts of Servia are the districts of the south and south-east, but especially the department of Toplitza, which may be said to contain the only remaining virgin forests of Servia, and whence are annually drawn large supplies of

walnut trunks and oak staves for casks. The heights of the Nischava valley, Stalatz, and Krushevatz furnish excellent building-timber. Oak forests are abundant on the Turkish frontier of Vrania. Walnut-trees, which attain to an enormous growth, have been mercilessly dealt with, the value of this timber having attracted the attention of Austrian merchants, who send agents to choose and cut the wood for exportation. The fir and juniper are found in the central and western valleys; and on the great Kopavnik range on the south-east, the pine on the heights of Zlatibor.

— Mining for ice is a possible future industry, according to the *American Geologist*, which states that an immense deposit of ice, thought to have its date from the glacial period, has been found in Pine Creek Cañon, Idaho. Capitalists, it adds, are considering the feasibility of mining it for commercial purposes.

— The *Industrie Textile* has a long account of the treatment of wild silks (that is, those which are furnished by silkworms other than those of the domesticated *Bombyx mori*) in their native countries. In India there are no less than fifty varieties of silk-bearing insects, the most important of which is called "tussur;" that is, "the weaver's shuttle." The caterpillar, like the moth, is of a great size, and feeds upon more than thirty species of plants. The cocoons of the tussur, which make their appearance twice in the year, are found attached to the branches of trees in the jungle in large oval masses. The caterpillar lives from thirty to forty days, and then weaves its cocoon. In four or six weeks from this time the moth comes out and lays eggs, from which comes a second generation of caterpillars. These wrap themselves in the cocoon, and remain hanging to the trees throughout the rainy season; that is, for seven or eight months. The cocoon, which is about four times the size of that of the mulberry silkworm, is composed of a double and interrupted thread of about 1,400 metres in length. The thread is impregnated with uric acid of sodium, which must be removed by the aid of an alkaline wash before the thread is unwound. The tussur is tended with great care: in fact, for centuries various religious usages have been employed in rearing it. The moth, which is a large insect of a brownish color, having its wings beautified by four transparent eyes, is venerated, and may be only approached by people of a certain caste. Unlike the tussur, which has been domesticated in India for some thousands of years, the cocoons of the other species are collected in the jungle. Among these is the *Attacus cynthea*, which feeds on the castor-oil plant, and of which the cocoon is white. Other species are the *Antheræa assama*, and the *Cricula trifenestra*, which lives on the mangrove-tree, and spins a cocoon of a bright golden color. The most important Chinese species is the *Antheræa pernyi*, which is cultivated in the province of Sze-chuan. In China also is found the most beautiful of all moths, the *Attacus altas*, which spins an enormous cocoon, covered at both ends with a very thick silk, known as "Fagara silk." In Japan are the *Ailanthus* caterpillar, and the *Yamanai*, which till lately was reserved for the exclusive use of the Mikado; and the exportation of the eggs was an offence punishable with death. At present attempts are being made to cultivate this species in France, and it is believed they will be successful.

— At a recent meeting of the Kansas Academy of Science, Professor F. H. Snow of the University of Kansas presented a paper upon the species of fossil leaves of the Kansas Dakota rocks. One of these species, of the new genus *Betulites*, according to Lesquereux, but referable to *Viburnum* according to Saporta, is named by Lesquereux *Betulites Vestii*, in honor of the indefatigable collector of these fossils, Mr. E. P. West. A large proportion of the specimens of this very variable species are found to be provided with stipules, which leaf appendages were not previously known to be connected with the Dakota leaves. These stipules, instead of being uniformly in pairs, one upon each side of the base of the petiole, as is the case in living dicotyledons provided with these appendages, are either single (in which case they may be entire, cleft, or parted), or they are in occasional instances entirely divided, constituting a pair of stipules; but, whether single or divided, they are nearly always unilateral, i.e., situated upon one side of the leaf-stem or petiole. In only one instance among at least one hundred stipulate leaves examined are the stipules bilateral, so that their unilateral character fairly distinguishes them from the stipules of modern dicotyledons. The significance of the discovery of these cretaceous stipules lies in the fact that we have here an additional proof of the descent of our modern forms of vegetation from the ancient forms by a gradual series of changes. To the superficial observer it would seem that our modern forest-leaves are absolutely identical with the cretaceous leaves, which, according to Dana's time-ratios, flourished about five million years ago. The opponents of the modern theory of origin of species by descent have derived a strong argument from the apparent identity of the modern with the ancient forms; but the identity is apparent only, not real. Lesquereux has noted the fact that the Dakota leaves, as a rule, have entire borders, while the modern forms of the same genera have denticulated or serrated borders. Another difference between the modern and the Dakota leaves consists in the greater thickness and toughness, or, in botanical language, the coriaceous character, of the ancient forms. But in the stipules of the Dakota leaves we not only have a prevailing unilateral position of these organs, as distinguished from their modern bilateral arrangement, but we are able to witness the gradual change from the single undivided form through the successive steps of transformation to the completely separated and finally bilateral pair; each stage of differentiation being indelibly stereotyped upon the sandstone matrix by which the leaves are enveloped.

— On Dec. 1, 1888, the resident population of Switzerland was 2,920,731, and the total population 2,934,027. Males numbered 1,427,377, and females, 1,506,650. Those speaking German amounted to 2,092,530; French, 637,972; Italian, 156,606; Romanche, 38,305; and various, 8,574. There were 1,724,957 Protestants; 1,190,008 Roman Catholics; 8,386 Jews; and of various or no religions, 10,706. The returns for the chief towns were, Bâle, 70,386; Geneva, 52,457; Berne, 45,966; Zurich, 27,632.

— Mr. G. W. Roosevelt, American consul at Bordeaux, in a report on the treatment of diseases of vines in France, says that in spite of the numerous inventions meant to destroy *Phylloxera*, it still continues its ravages. One of the most recent plans is that of an American, Mr. L. H. Davis, who inoculates the vine, through a carefully made excision, with a preparation which he claims is destructive to the *Phylloxera*, while it leaves the vine uninjured. It is too soon yet to speak of the results of this plan. Dr. Griffin advocates a distribution, by a machine constructed by him, of a substance which can be used in either a dry or a liquid state. Last spring he operated on a vineyard placed at his disposal by the French Government, and had the satisfaction of seeing the vines treated by him sound and healthy, while other plants in the same vineyard were perishing, The most generally employed remedy has been found to be very serviceable, and free from the danger that was thought to follow it; that is, the submersion, for not less than forty days, in carbon of sulphur dissolved in water. In light permeable soils a strong mixture is used, but on hard soils a weaker solution is better. Within the past few years the actual area of the vines destroyed by this pest is 1,200,000 hectares, or, roughly speaking, one-half of the vineyards of France; and, if we remember that a hectare of vines is worth about 6,000 francs, we can see what a terrible loss France has suffered. In the case of *Oïdium*, as in that of *Phylloxera*, no positive remedy has yet been discovered; but the usual mode — that is, the application of sulphur, pure or mixed — checks the disease, and at the same time helps the growth of the vine. In fact, so great have been the good results of the use of sulphur, that it will for the future be used in most vineyards, even where *Oïdium* does not exist. Till the year 1885 no remedy was known for mildew. Since that year, however, salts of copper have been successfully employed, though there is some doubt whether that substance is really beneficial to the vineyards. The most general method is to pluck off the diseased leaves and burn them. Besides these, there are other methods, such as the use of *bouillie bordelaise*, *eau céleste*, ammoniate of copper, and verdigris with powdered sulphate of copper. On account of the recent appearance of the disease called "black rot," no satisfactory remedy has yet been tried. With regard to anthracnose, if steps are taken early in the spring, the disease may be brought under control. Perhaps the best remedy is a mixture of lime and sulphur. A first

sulphuring is given when the shoots are four or five inches long; then, if lesions appear, the operation is repeated in about a fortnight with a mixture of lime and sulphur, the proportion being one part of sulphur to three of lime. A mixture of plaster and sulphate of iron has also been very successful. The only really efficacious remedy for pourridie is by removing and burning all roots showing traces of the disease. Erinnose may be treated like mildew; that is, by repeated applications of sulphur.

— The International Prison Congress will be held in St. Petersburg in the summer of 1890. A prize of four hundred dollars is offered by the conductors of the *Prison Discipline Review*, for the best essay on the subject, "What in the most civilized nations has been the historical development of the institutions relating to the correctional education of minors who have been convicted of crimes at common law, or who have been put in custody for idleness and vagabondage, or with a view to paternal discipline?" The essays must be written in Russian or French, and must be sent to the president of the organizing committee of the Fourth International Prison Congress, at St. Petersburg, not later than May 15, 1890. They must be furnished with a motto, and accompanied by a sealed letter containing the writer's name and address.

— The Paris correspondent of the *Medical Press* writes, under date of July 13, 1889, that in the last sixteen years the number of suicides increased in France 55 per cent. Their proportion in regard to the population rose during that period from 15 to 21 per 100,000 inhabitants. In 1872 the total number of suicides was 5,275, while in 1887 8,202 were registered. Women, as in other countries, are less prone to self-destruction than men, — 1,768 (22 per cent) against 6,434 (78 per cent). The frequency of suicides increases with age. Up to the fortieth year the propensity is about the same in both sexes, but after that the men take the lead. There were 2,894 unmarried, 3,706 married, while 1,355 were widows or widowers. As to the social condition, 2,614 were in agricultural pursuits, 2,276 belonged to varied industries, while the remainder were in business, or were householders, domestics, clerks, etc. The rural population furnished a higher number of suicides than the urban, — 4,279 of the former to 3,807 of the latter. As to the period of the year, summer and spring furnish the largest contingent. The means employed were chosen in the following order of frequency: strangling, immersion, fire-arms, asphyxia by charcoal, sharp instruments, poison, precipitation from heights. The presumed causes were, insanity, 2,023; physical suffering, 1,407; poverty and reverse of fortune, 1,059; domestic affliction, 1,116; drunkenness, 914; disappointed affections, 305; etc. In the above list, alcoholism producing cerebral affections takes the first rank. During the last fifty years the consumption of alcohol has increased threefold, and the number of insane persons fourfold. The liquor which contributes the most to producing mental derangement is absinthe, of which the French are so fond. When a man gets in the habit of taking that drink, he is sure to commit some crime or destroy himself.

— Dr. H. W. Wiley, chemist of the United States Department of Agriculture, in a note accompanying a recent report on the manufacture of sugar by the diffusion process, calls attention to the advancement made in the last few years in the sugar-industry of Louisiana, and to the important part taken by the government in developing that industry. In 1884 the Department of Agriculture established, in connection with the exposition at New Orleans, a complete sugar-laboratory, and at the same time placed an experimental diffusion battery on exhibition. It also established at Magnolia Plantation, Lawrence, La., a complete chemical control of the sugar-factory. In December of the same year, the attention of sugar-growers was called by Dr. Wiley to the importance of chemical control and new methods. In 1885 the department made an unsuccessful attempt to introduce the process of diffusion into Louisiana on a manufacturing scale, and during the next year one hundred and fifty tons of Louisiana cane were shipped to Kansas and worked by the process of diffusion, securing a yield fully thirty per cent greater than the average milling process would have given. In 1887 the diffusion process was successfully introduced by the department on Magnolia Plantation. During the coming season the diffusion process will be used on four large plantations in Louisiana. Many other planters have also instituted a chemical control of the factory, and a sugar experiment station has been in successful operation at Kenner for four years. The practical result of the work first undertaken in Louisiana by the Department of Agriculture is seen already in a more scientific agriculture, a better knowledge of the problem of sugar-manufacture, a more scientific method in the sugar-house, and the introduction of recent and improved machinery. Before the time first mentioned, the average yield of sugar per ton on the best plantations in the State was scarcely one hundred and forty-five pounds. It is now over two hundred pounds.

— Cholera is reported as raging in Peking with great violence. All foreigners, with the exception of a few officials, have fled to the mountains.

— The total length of submarine cables is 209,322 kilometres (130,066 miles).

— Dr. A. König of Berlin has been promoted to the rank of extraordinary professor of physics.

— Professor Lankester proposes, in *Nature*, that this new word, "Mithridatism," be admitted to the scientific vocabulary, to signify that immunity from the effects of a poison which is induced by the administration of gradually increased doses. The selection of the word has reference to the fable concerning Mithridates, King of Pontus, that he became so charged with the poisons he experimented with, that he obtained an immunity from them all.

— In a paper on the pathogenic properties of the microbes present in malignant tumors, by M. Verneuil, read at a recent meeting of the Paris Academy of Sciences, the author still adheres to the opinion already enunciated in 1883, that these parasites have nothing to do with the initial stage of boils, ulcers, cancer, and the like. At the same time he does not regard their presence as a matter of indifference, but admits that in certain cases they may themselves possess special pathogenic properties, in virtue of which they act on the system like septic poisons.

— At a meeting of the Academy of Sciences at Paris recently, M. Mascart gave a true account of the striking by lightning of the Eiffel Tower, which took place on Aug. 19, and exaggerated reports of which appeared in the daily papers. The conductor was struck, with the normal results, showing perfect communication with earth, and consequently complete safety of the structure from any danger on this score.

— By the will of the late Alonzo Clark, M.D., LL.D., it was placed in the power of the faculty of the New York College of Physicians and Surgeons to bestow a scholarship, with an income of about nine hundred dollars a year, for the purpose of promoting the discovery of new facts in medical science. This has been bestowed, for three years from Oct. 1, 1887, upon T. Mitchell Prudden, M.D., of New York City.

— The *Handels Museum* states, on consular authority, that the fibres of the banana, or paradise fig-plant, are the most important products of the soil in Africa which have hitherto remained unused. This fibre, which is capable of being divided into threads of a silky fineness, extends the entire length of the plant, which has no branches. In Central America this fibre, without any other preparation than the drying, is used for shoe-strings, and for strings and ropes for various purposes. During the twelve months of its vegetation the banana-plant produces only a single bunch of fruit, after which it dies, but from its roots four to ten young plants spring up. In its native place, a bunch of fruit of the banana is worth about twenty-five cents, while the plant, which is thrown away, is worth ten times that amount to a soap-factory, paper-mill, or coffee-bag manufacturer. The leaf of the banana, composed, with its stalk, of the toughest and finest threads, has hitherto only served the native women as an umbrella during the rainy season, as a carpet to sit upon, or a bed to sleep on. "If," says the *Handels Museum*, "this plant, in the innumerable banana plantations of the entire tropical world, is only properly utilized, the whole human race will obtain such a vast mass of textile material that it is certain to influence the value and cultivation of other kindred plants, such as hemp and flax, cotton, jute, etc., and nobody can predict the consequences which the utilization of this hitherto unnoticed material may have."

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ABOUT TEN DAYS AGO there appeared in the *New York Sun* a sensational article to the effect that, on account of the depreciation in the value of Baltimore and Ohio stock, and the loss of income from dividends on the stock, Johns Hopkins University was ruined. What the animus of this article was we do not know. It may have been written with the hope that it might further the interests of some stock jobbers, or it may have been written by some enemy of Johns Hopkins bent on doing the university what harm he could. A glance at the article in question showed that it contained nothing but what was perfectly well known months ago, so far as ill was concerned, and that all reference was omitted to the successful efforts of the university's friends to help it at a time when it was temporarily short of ready cash. We were so impressed at the time with the character of the article, that we made no allusion to it last week, supposing it to be evident enough on the surface that it was all published to produce a sensation, and not to record a plain statement of fact. We should not now have any thing to say were it not for the frequent allusions published in our exchanges, showing that some read the *Sun* and accept its fictions as news. All that need be said now is that for years the trustees of Johns Hopkins University knew, as any body of sensible men would know, that, as a good portion of their income-bearing property was in Baltimore and Ohio stock, it would be wise to save up some of the income to provide against any cessation of dividends. This was done. Again, when the dividends stopped some months ago, steps were taken to raise additional funds to cover expenses, and these efforts were rewarded with all the success desired. The result is that the university goes on with ample means to continue as a model to all our American universities, as it has been from the start, with a full faculty on full pay.

THE PREPARATION OF JAPANESE LACQUER AND THE MANUFACTURE OF WAKASA WARE.[1]

JAPANESE lacquer is the product of a tree (*Rhus vernicifera* D. C.) which grows throughout the main island of Japan. It attains a large size, the trunk sometimes measuring a metre in diameter. It is said the tree will live for forty years, but only comparatively young trees are valued for the production of lacquer. Having yielded for several years, they are cut down, the lacquer extracted from the branches, and young trees take their places.

The principal section of the lacquer industry is between the parallels of 37° and 39°, beginning about one hundred miles north of Tokio. The best lacquer, however, comes from much farther south, from Yoshino, in Yamato.

The lacquer exudes from horizontal cuts in the bark, in the form of a rather viscid emulsion, and may be collected from April to the end of October. In the spring it is more watery than in the later months. However, the sap never flows so freely that it can be collected in vessels, as has been stated by writers. It exudes slowly, and is collected by means of a pointed, spoon-like instrument, and transferred to a wooden receptacle or tube of bamboo. Several cuts are made in each tree, the last as high as a man can reach. Having thus prepared a dozen or more trees in rapid succession, the collector begins to collect the juice from the cuts in regular order, beginning with the one first cut.

Having finished the collecting, he takes other groups of trees, and after about four days returns to the first, where, after removing the accumulated yield, he cuts again into the same trees, and repeats the same rôle fifteen or twenty times. Thus the work may go on for eighty to a hundred days. The utmost yield of a single tree is about forty to fifty cubic centimetres of raw lacquer.

As the sap first exudes, it is a grayish-white thick or viscous fluid, which quickly turns yellow, and afterwards black where it is in contact with the air.

The sap thus collected is *ki-urushi*, *urushi* being the general name for lacquer. An inferior kind is obtained from the branches when the trees are cut down. The branches are soaked in water for several months, then taken up and slightly warmed, when a small quantity of sap exudes. This is *seshime urushi*.

The lacquer is strained through cotton cloth to free it from bits of wood and dirt, first being thoroughly stirred to break up lumps and make a uniform mixture. The product thus purified is known as *seshime urushi*; but this name, which has already been used to designate the lacquer from the branches, has now a different meaning, and is applied to the cheaper kinds of raw lacquer, such as are used for the first coats in lacquering. These lacquers have usually lost some of their water by stirring in shallow receptacles exposed to the sun. They have undergone no further preparation.

Many varieties of lacquer are prepared for special purposes, ranging in price from one or two to six or seven dollars per kilogram. These differ in quality and color. There is a famous black lacquer prepared by the addition of iron, which forms a chemical combination to be mentioned further on; while red, green, yellow, and other colors are imparted by addition of various pigments, as cinnabar for red, orpiment and indigo together for green, orpiment for yellow, etc. Ultramarine is decomposed by lacquer, giving off sulphuretted hydrogen. Certain lacquers have a small proportion of a drying oil (perilla oil) added to them. The lacquer known as *shiu urushi* contains from one to ten per cent of this oil. The name "*shiu urushi*" means "cinnabar lacquer," and is applied to this variety because it is commonly used to mix with cinnabar when a red lacquer is required.

The emulsion as it comes from the tree consists of an aqueous

[1] Abstract of a paper read by Romyn Hitchcock before the Chemical Society of Washington, April 11, 1889.

fluid holding in suspension numerous very minute brown globules and a smaller proportion of lighter-colored larger globules. The former are insoluble in water, but soluble in alcohol. The latter dissolve in water.

The raw lacquer is almost completely soluble in alcohol, ether, carbon bisulphide, benzine, and solvents of gum-resins in general. The most important and abundant constituent is urushic acid, which occurs in the form of the minute spherules already mentioned. The acid is obtained by evaporating the alcoholic solution to a sirupy liquid. The evaporation must be carried on over a water-bath. If too much heat be applied, a tough, black, rubber-like substance is obtained, which I found very troublesome to remove from the dish, and only strong nitric acid would affect it in the slightest degree.

As thus obtained, urushic acid is soluble in alcohol, chloroform, etc., but quite insoluble in water. It possesses marked acid properties, turns litmus-paper red, and forms salts with metals. With iron salts it forms a black compound, to which the color of the fine roiro lacquer is due. With plumbic acetate it yields a gray, flocculent precipitate.

Although the drying, or rather the hardening, properties of lacquer are doubtless due to the oxidation of urushic acid, the product extracted by alcohol possesses no drying qualities. This fact was first observed by Professor Rein, in 1874. More recently Korschelt and Yoshida have found that a peculiar albuminoid of lacquer effects the drying by a diastatic or fermentive action. The fact seems to be that the lacquer hardens only when the albuminous substance is present. If heated above 60° C., or above the temperature at which albumen coagulates, the lacquer will not dry. The strongest evidence of the importance of the albuminoid to the hardening process is found in the fact that while the urushic acid will not dry by itself, it immediately hardens if a portion of the unboiled gum and albumen that does not dissolve in alcohol be added to it, and the rapidity of hardening depends upon the proportion added. It is notable that the aluminoid does not lose its peculiar property of effecting this oxidation by treatment with alcohol. Besides urushic acid and the albuminoid, raw lacquer contains a gum resembling gum arabic, which doubtless imparts some useful properties to the lacquer, and a volatile acid, to which Professor Rein ascribes the poisonous effects of lacquer.

We now come to the further preparation of lacquer for use in the manufacture of the several varieties of lacquered articles, and I would say that whoever is sufficiently interested in the subject to spend an hour at the National Museum will find the process of manufacture very fully illustrated there.

A portion of the raw lacquer, about sixteen pounds, is poured into a large circular wooden vessel, and vigorously stirred with a long-handled tool for five or six hours, while the heat of a small charcoal furnace is ingeniously thrown upon the surface to evaporate the water. During the stirring, certain ingredients may be added from time to time. The *roiro*, a fine black lacquer, is made by adding iron at this stage. In Tokio a soluble salt of iron is used, but the Osaka manufacturer objects to that, asserting that it injures the quality of the lacquer. The material used in Osaka is the fine iron dust collected from the grinding of knives. This is added in quantities of about a teacupful of powder mixed with water at a time, until the desired color is obtained. When the work is finished, the lacquer is poured into a vessel to settle, and is afterwards drawn off from the sediment.

The wood generally used for lacquer-work is the light, easily worked *hinoki*, a coniferous wood. It is prepared to receive the lacquer in various ways. For inferior work it is first covered with paper, but in the finer qualities paper is not used. The operations to be described apply to the manufacture of that variety of lacquer known as Wakasa lacquer, and are from personal observation. The wood is first carefully smoothed, and the corners of the boxes strengthened by gluing pieces of cotton or hemp cloth around them with raw lacquer. All joints and imperfections are then filled with *tsugi urushi* (*tsugi*, "to fasten"), which fills like putty. This is a dark-colored mixture composed of rice-flour made into a paste with water, and mixed with *seshime urushi*. It soon hardens so that it can scarcely be cut with a knife. Sometimes finely cut hemp is mixed with the *tsugi urushi*. The work is then covered with *jinoko*, a mixture of *seshime urushi*, and a coarse powder of a yellowish color. The mixture is soft, of a yellowish-brown color, changing to black by exposure to the air. It is spread with a wooden instrument called *hera*. The article is left for a few days in the open air to allow some of the water to evaporate, after which it is placed in a moist-air closet to harden. In this way a very hard, gritty surface is obtained, affording an excellent ground for the succeeding coat.

This process is not applied in making inferior goods. For these a mixture of the powder with glue is sometimes used, and for this reason cheap ware sometimes blisters when used with hot water, the glue swelling if the water reaches it. Similar blistering may also be occasioned by the natural gum of the lacquer if it should be present in excessive quantity.

The next process consists in covering the entire box with two coats of lacquer, containing a finer powder known as *tonoko*, which is a kind of ochre much used in Japan for cleaning and polishing. This is likewise evenly spread with the *hera*. Three coats of this are applied over the joints. The object of this process is to secure an even, smooth-grained surface for subsequent work. The surface is finally rubbed down with a kind of stone called *toishi*.

The parts that are not to receive any decoration are now ready for the finishing applications of lacquer. The other parts are next covered with a black lacquer, *naka muri urushi*. The lacquer used is *shitaji urushi* mixed with a kind of black lacquer known as *honkuro*, probably the best kind of roiro lacquer. It is applied with a brush, and requires to be rubbed down.

Two coats of black lacquer are now applied. The first is roiro put on with a broad brush. This dries with a brilliant reflecting surface. When quite hard, the second application is made, and in this, while still soft, the designs are impressed. I use the word "impressed" because in the Wakasa lacquer there is no painting or drawing, but the figures are produced in a very curious manner. The white decoration is applied by dropping egg-shell powder in patches here and there. This is done very skilfully by the hand. The other designs are made by pressing various forms of leaves into the soft surface. Thus, the radiating or wheel-like pattern is produced by so arranging the needle-like leaves of the pine, the more complex leaf-pattern with the leaves of an evergreen (*Thuya orientalis*), while many other effects are made by scattering over the surface husks of rice, and these mingled with very short pine needles. The mother-of-pearl from shells is also used. The designs become more or less modified by the subsequent operations.

The lacquer retains the impressions thus produced, when, after the leaves, etc., have been embedded about a day, every thing except the egg-shell powder and mother-of-pearl is removed. The article is then put in the moist closet until it is thoroughly hardened, which may require ten days or a fortnight. The egg-shell is in little heaps, the leaf impressions are beneath the general surface. It is now necessary to fill up all depressions and once more secure an even surface. The first step is to rub down the most conspicuous projections until there is much less irregularity of surface, but even after several successive coats of lacquer there will remain some elevations and depressions.

The next application is a transparent lacquer colored yellow with arsenic sulphide. This is put on with a *hake*, and spread as evenly as possible. The object of this is to afford a yellow ground for the gold which is to follow. A thin coat of *shiu-ai urushi* is spread over this, and the whole completely covered with gold leaf. Then successive coats of the same lacquer, which is a transparent red lacquer, are applied until the surface is quite even. The surface then appears entirely black, beneath which all the gold and decorations are concealed.

Instead of a red ground, green is sometimes desired, as in green lacquer. To make this, the *shiu urushi* is mixed with a green pigment. The next operation is to rub down the surface with stone *toishi* or *sai kido* until the design is again visible. The pattern is now revealed in gold with the pure white of the egg-shell powder to relieve the effect. The work is finally rubbed with a special kind of charcoal, which gives a perfect surface, but to make it more brilliant it is covered with a finishing coat of fine lacquer.

To make practical application of these remarks, I would say that

the peculiar qualities of lacquer make it seem worthy of more consideration than it has received in this country. It gives a surface to wood much harder than our best copal varnish, without brittleness. It takes a polish not to be excelled, which lasts for centuries, as may be seen in the old treasures of Japan. It is proof against boiling water, alcohol, and, indeed, it seems to be insoluble in every agent known. It is the best possible application for laboratory tables. I have a set of photographer's developing trays that have been in use for more than a year, and I find them excellent and cheap. In Japan it is used for many household articles.

A very serious objection to the use of lacquer in this country is the danger of lacquer-poisoning from the fresh material. I have recently heard of a piano-maker who tried to use it, but it affected his workmen so seriously that he was obliged to give it up. The Japanese are very much in dread of the poison, as I found when I tried to get some of my students to accompany me as interpreters to the places of manufacture. Those who are subject to the poison suffer precisely as patients afflicted by the *Rhus*, or poison-ivy. Of course, those engaged in lacquer-work are not affected by it; but whether one acquires immunity after a time, I am unable to tell. However, if the poison is a volatile acid, it would seem possible to remove it by a heat that would leave the lacquer uninjured, and thus make it available for use in this country.

THE PRODUCTION OF SUGAR.

BEFORE proceeding to describe the processes adopted for the extraction and refinement of sugar, says Ward Coldridge, in a sequel to an article on the same subject reprinted from *Knowledge* in *Science* of Aug. 30, it will be advisable to explain the difference between what a chemist means when he speaks of "a sugar" and what people generally understand by sugar. The chemist uses sugar as a generic term, and includes under it — strange as it may seem — things which have no sweetness, and excludes the sweetest of all substances, the newly discovered saccharine. He subdivides his sugar into two classes, — first, true sugars, which are distinguished by their power of undergoing alcoholic fermentation; and, secondly, bodies which do not suffer fermentation. Recent research has diminished the number of substances of the second class, so that for the purpose in hand this class can be eliminated, and our attention can be fixed on the first group only. These fermentable substances which yield alcohol are typically represented by grape sugar and cane sugar. Now grape sugar is less sweet than cane sugar, and its chemical constitution is different. Grape sugar has the formula $C_6H_{12}O_6$; that is, its molecule contains six atoms of carbon, combined with twelve of hydrogen and six of oxygen. When suitably treated with yeast, it ferments, and forms alcohol, and evolves a part of its carbon and oxygen as carbonic acid, one of the two substances from which the plant originally began to form its sugar. The equation is,

$$\underset{\text{Grape sugar}}{C_6H_{12}O_6} = \underset{\text{Alcohol}}{2\,C_2H_6O} + \underset{\text{Carbonic acid.}}{2\,CO_2}$$

It will be remembered that the plants originally formed their sugar from water and carbonic acid; and now it can be understood that Nature, when she wishes to dispose of an excess of sugar, transforms it into alcohol and carbonic acid. There is thus a reversion to the original type: —

$$\left.\begin{matrix}\text{Water}\\ \text{and}\\ \text{Carbonic acid}\end{matrix}\right\} \longrightarrow \text{Sugar} \longrightarrow \left\{\begin{matrix}\text{Alcohol}\\ \text{and}\\ \text{Carbonic acid}\end{matrix}\right.$$

But alcohol takes the place of water. In the face of the wide difference between the actions of water and alcohol on humanity, it may seem absurd to say that the final products bear any resemblance to the original. Yet, in spite of the physiological difference, the chemical relation of alcohol to water may be summed up in the statement that alcohol is water in which one of the two hydrogen atoms are replaced by a group of carbon and hydrogen atoms, "C_2H_5." Thus,

Water.....	H. OH
Alcohol.....	C_2H_5. OH

Nature does not, however, desire to flood the world with alcohol, for she very quickly transforms it, by aid of a countless army of minute living organisms, into vinegar; and thence, in turn, she passes back to what she started from, — to water and carbonic acid. So the cycle of changes runs on; in all stages it is always proceeding.

The conversion of common sugar is not so direct. Cane sugar must drink water before it can form alcohol. But the draught of water acts on it chemically, and converts this form of sugar into two others, one of which is uncrystallizable. When the sugar becomes thirsty at the temperature of the West Indies, it absorbs water with greater eagerness, and as a result a quantity of molasses or treacle is formed.

The older method of extracting the sugar — and in future in this paper the word will be used in its commercial sense only — was to take the canes which had been cut off as near the roots as possible and stripped of their leaves, and to crush them. From the crushed canes the juice exuded. This juice held in solution, besides the sugar, various substances of an albuminoid nature containing nitrogen, and of mineral bodies chiefly that phosphate of lime (Ca_32PO_4) which is obtained from bones. The object of the process is to remove these foreign substances, so as to have command of a comparatively pure solution of sugar in water. The albuminoids must be removed as quickly as possible, for they soon begin to assert their presence by causing fermentation in a manner analogous somewhat to yeast. The plan adopted is to collect the juice in large tanks, and then to add a small quantity of lime. The liquor is next heated to a suitable temperature; a thick scum forms on the surface. When it is considered that this coagulation of the albuminous substances has proceeded far enough, the clear liquor is drawn off from below. From this solution the manufacturer desires to obtain as much sugar as possible by crystallization. He therefore boils off the water quickly in open copper vessels, and incidentally improves the purity of his product by removing such scum as may form. The thick sirup which remains is run into coolers and allowed to stand until no more sugar-crystals separate. Finally he places the magma of crystals, and the mother-liquor from which the sugar has separated, into casks with perforated bottoms. The uncrystallizable thick brown viscid mother-liquor which draws away is the common molasses or treacle which is chiefly used in the manufacture of rum.

The process which has been thus outlined is far from being economically perfect. In fact, it is extravagant and wasteful. To begin with, the mechanical contrivances generally used by the colonial sugar-planter for crushing his canes are not perfect: he might obtain more juice from a given weight of cane. A somewhat recent invention seems to have a future before it in this direction. The principle is very simple and well known. It utilizes the fact that a body, when rapidly whirled around, will fly off tangentially unless restrained. The machinery is here so arranged that the juice may escape, but the solid pulp is restrained, and at the end of the operation is left in a dry condition.

However, the most serious defect of the above process arises in the actual manner of working up the comparatively pure sugar solution. Above it was said that the manufacturer rapidly boiled off the water; of course economy of time is an element to be considered. Allowing, then, that the water is removed quickly, it may seem at first sight that the process is excellent. But as a fact it is very wasteful. Why it should be so will be understood by realizing the fact that at the temperature used the water is not merely evaporated, but that some enters into combination with the cane sugar and converts it into grape sugar, as given above, and in the final result a large proportion of molasses is formed. So the question has been considered whether it is possible to remove this water under such conditions as will prevent, or at least diminish, the chemical change. The answer has been an affirmative one. The liquor, instead of being concentrated by boiling down under atmospheric pressure, is now heated in vessels from which the air can be exhausted. Consequently, according to the well-known connection between the temperature at which water boils and the pressure on its surface, the temperature of ebullition in a vacuum will be much lower than in air; the sugar solution will thus be kept while concentrating at temperatures below that at which it readily drinks water, and becomes in part uncrystallizable.

At the present time the colonial sugar manufacturer is proving

himself to be a man of strong conservative habits, and very slow to recognize the great practical improvements which have taken place. But the day must come, and that quickly, when the exigencies of competition will lead him to adopt artificial advantages which have proved of service to the continental producer of sugar from beet-root. Then, perchance, the prediction of the Brazilian commission, quoted in the former article, will be verified.

The methods employed for the extraction of the raw sugar from the beet are practically the same as for raw cane sugar; but the impulses towards change and improvement, and the necessity for the rapid evolution of more economic manipulation of details, have led to the foregoing inventions.

One new process, however, has been invented which so strikes at the root of the old process that it merits a description by itself. Instead of crushing the beet-root to a pulp, and then extracting the sugar juice together with albuminoid and gummy matters, it aims at removing the sugar without these foreign substances, and so avoids the subsequent labor for their removal. The beet is cut into slices, and these are washed with water. It is claimed that the sugar diffuses out through the walls of the unbroken cells, whereas the albuminoids and the gummy matters of far greater molecular complexity cannot so escape. When the washing is carried out systematically, the process works exceedingly well. Again, the principle of this improvement, like those which underlie the others, is quite old. The walls of the unbroken cells are perforated with fine pores. The particles of sugar can pass through, but the bulky albuminoid aggregates cannot pass. It is like a sieve at work on a minute scale: sugar for the fine gravel, albuminoids for the stones, gummy matters for the lumps of clay, and the minute pores for the holes of the sieve. The originality consists in the application. The same plan has been used over and over again to detect arsenic in a viscous mixture of substances; the mixture is merely boiled with dilute hydrochloric acid, and then floated on a parchment membrane on a vessel of water, the arsenic passes through into the water, and the filth with which it was mixed remains behind. This diffusion-process, which thus owes its birth to the experiments of the Englishman Graham, is much used on the continent, and its applicability to the production of sugar from the sorgho grass is a source of confidence to those who are trying to develop this new American industry. The sugar trade at this moment watches with interest the practical experiments which are now being made, with, as far as can be judged at present, satisfactory results on its application to the extraction from the sugar-cane. Even in Japan an effort has been made to utilize it, and the government have aided the industry by a bounty, and have, it is said, a considerable share in a large manufactory which is now being floated; here, too, the Japanese evince their keenness in adopting Western inventions, and even in extending European ideas.

But the manufacture of sugar does not end with the production of raw sugar; in England it commenced with the raw sugar. The refining of sugar chiefly consists in the removal of the coloring matter which adheres to the small crystals of the raw sugar, and the casting of the purified crystals into moulds. The same processes are applied both to the raw material from the cane sugar, which is pleasant to the taste, and to that from the beet, which smells unpleasantly and is uneatable. The method is the same as a chemist would adopt, who, in the course of an investigation, prepared a substance which he wanted in a state of perfect purity. The sugar is dissolved, and the solution filtered to remove mechanical impurities. The solution by its tint shows the presence of coloring matter, which is removed by filtering through animal charcoal, when it will filter from the charcoal in a colorless condition. It is a curious experiment to shake a wine-glass of port wine with some finely divided animal charcoal; after filtering, the wine is obtained as colorless as water, but it completely preserves all its characteristic properties of taste unaltered. The colorless solution of sugar is then concentrated in a vacuum pan until of the right strength for rapid crystallization. To ascertain this point, the workman places a drop between his finger and thumb, and tests into what length of thread it can be drawn. If the right strength has been reached, some cold unboiled solution is added. Crystals at once appear. If the sugar is finally to be cast in loaves, the conditions are so adjusted as only to produce small crystals. The mixture of crystals and sirup is then heated to within thirty or forty degrees of the boiling point of water, and poured into the iron moulds of the familiar shape. At the apex of the mould there is an aperture which when unplugged allows the sirup to drain away. Finally, the remaining traces of sirup are removed by allowing a quantity of fine colorless sirup to percolate through the loaf. After the loaf has been subsequently dried and turned in a lathe, it is ready for the market.

Thus, then, the production of sugar is completed. The plants utilize the waste products of animal existence, and work their wonderful chemical transformations. Man gathers wealth from these storehouses of nature, and exercises his ingenuity in obtaining as much as possible. So the history of a lump of sugar contains the story of how plants work, and how mankind inherits their store by aid of labor both of mind and body.

HEALTH MATTERS.

Weight of the Body in Typhoid-Fever.

DR. L. H. COHIN has published a thesis in which he sets forth the daily variations in the weight of patients in typhoid-fever. This publication is the result of studies pursued in Cochin Hospital, where, by a skilful contrivance, successive series of patients were carefully weighed every day, and the weight recorded on their charts, from the beginning to the end of the fever.

The observations of Dr. Cohin, as given in the *Boston Medical and Surgical Journal*, show that the loss of weight varies considerably for each individual. With some it was two hundred grams a day: this was the minimum. With others it was five hundred grams: this was the maximum. The mean of nine observations gives four hundred grams of loss per day; but on taking mild cases, free from complication, the mean fell to three hundred and twenty grams, which represents the daily loss in typhoid-fever of average intensity. The mean of the daily gain, when convalescence was established, was two hundred and eighty grams. The maximum of loss of weight corresponded to the end of the second week, or the beginning of the third. In reviewing the researches on the causes of the loss of weight in typhoid patients, the writer establishes the fact that the febricitant lives at the expense of his own substance.

The conclusions of these studies are as follows: (1) Typhoid-fever presents two distinct periods, one of loss and one of gain; certain accidental causes may modify them, but cannot affect their general character. (2) The daily loss is due to febrile combustion chiefly, and but little to abstinence. (3) The daily loss varies with individuals. (4) The losses in nitrogen and in weight are almost parallel with the march of the temperature, without always following it exactly. (5) The study of the weight-chart may aid in prognosis, a continual rise in the weight being a sign of convalescence. (6) The complications of the disease augment the loss of weight. (7) The study of the loss of weight enables the physician to determine with precision the action of nutritive substances in fevers. (8) The loss of weight in a typhoid patient takes place each day in a uniform manner.

HEALTH IN THE FRENCH ARMY. — According to the official report of the French minister of war, the mortality among the French troops has fallen from twelve to eight per thousand during the last year. From 1875 to 1887 there have occurred 141,648 cases of typhoid-fever, and 21,116 deaths. The percentage of this disease has materially decreased of late, owing to the attention that is being paid to pure water-supply in the barracks. The value of vaccination is proved by the fact that the number of small-pox cases has fallen from 1,042 to 242, and these were mostly among recruits.

NEW METHOD OF PRECIPITATING SEWAGE.—The problem of the disposal of the sewage of large towns has long defied the efforts of sanitary engineers to cope with it in a satisfactory manner. A new method of sterilizing and precipitating sewage has just been brought out, which, it is claimed, accomplishes all that can be required of it at as little cost as any such system can be worked. The method has been put in practice experimentally at

the Wimbledon Sewage Works, England. The principle underlying this plan of dealing with sewage is the employment of "amine" salts in combination with milk of lime. At Wimbledon, herring brine is used, and on mixing with the lime a very soluble gaseous re-agent is evolved, to which the inventor has given the name of "amerinol." This re-agent possesses a peculiar briny odor, and when introduced into sewage is said rapidly to extirpate all micro-organisms capable of causing putrefaction or disease. The effect is almost instantaneous. By the action of the lime, violent flocculation is caused, and subsidence takes place in about half an hour, the putrid smell of the sewage being replaced by the peculiar briny odor. According to Dr. Klein, the destruction of micro-organisms is absolute. The total cost per annum of treating London sewage by this method is put at $625,000. Should the residue prove to possess any value for agricultural purposes, its sale would tend still further to reduce the expense.

VACCINATION IN JAPAN. — Vaccination, according to *Medical News*, has been obligatory for some years in Japan, and every infant is required by the police to be vaccinated. The value of the procedure is, however, well recognized by the people themselves, and the government hospitals in every town are always thronged with applicants on the weekly "vaccination day." In 1886 there were 1,531 vaccinations to each 10,000 inhabitants.

BOOK-REVIEWS.

Benjamin Franklin. By JOHN T. MORSE, Jun. Boston, Houghton, Mifflin, & Co. 12°. $1.25.

THIS is the latest issue in the American Statesmen Series, and is well worthy of its place. It treats Franklin exclusively as a statesman, his scientific discoveries being only incidentally alluded to, and his business life very slightly sketched. His early years, too, are passed quickly over, the author thinking that Franklin himself has recounted his early life so admirably that no one else can successfully deal with it. Accordingly, with the third chapter we find our hero despatched on his first mission to England, and all the rest of the book is devoted exclusively to his public services. Mr. Morse shows perfect mastery of his subject, and his style is clear, refined, and dignified; and these qualities make the book interesting throughout. His account of Franklin's labors in England is sufficiently full, and shows why in the main they failed. The dispute between the people of Pennsylvania and the proprietaries of the province was one that could not be settled, and in fact was not settled, until the people had the entire government in their hands. But Franklin's efforts on behalf of Pennsylvania first, and afterwards of all the Colonies, form a very interesting chapter of American history, which is well set forth in this book. The most important of Franklin's public services, however, were rendered in the capacity of minister to France, and it is this part of his work that Mr. Morse has most elaborately treated. Franklin's labors were by no means confined to securing the alliance of France, but included also the difficult task of borrowing, or begging, money in France and everywhere else where it could be got, together with a great variety of services besides. He had for a time two colleagues, but neither was of much use, while one was a mischief-maker of the first order, so that the whole burden virtually fell upon Franklin; and Mr. Morse probably does not exaggerate when he affirms that Franklin's services to the national cause were only less arduous and important than those of Washington.

With regard to the character of his hero, our author expresses himself with some enthusiasm. "Intellectually," he maintains, "there are few men who are Franklin's peers in all the ages and nations. . . . He illustrates humanity in an astonishing multiplicity of ways at an infinite number of points. He, more than any other, seems to show us how many-sided our human nature is." This may be somewhat exaggerated, but it is substantially true; for few men in history have been great at once in such widely separated departments as politics, science, and literature. With regard to his moral character, Mr. Morse, while not extenuating his faults, prefers to dwell on his excellences, which were undeniably of a high order. "As a patriot, none surpassed him," and "the chief motive of his life was to promote the welfare of mankind." "It is not worth while to deify him, or to speak with extravagant reverence, as if he had neither faults nor limitations. Yet it seems ungracious to recall those concerning one who did for his fellow-men so much as Franklin did. Moral, intellectual, and material boons he conferred in such abundance that few such benefactors of the race can be named, though one should survey all the ages." This is high praise, but it is in the main well deserved; and now, when disinterested patriotism is rare among us, Franklin's example ought to be kept before our eyes, and we hope that this book will be widely read.

Darwinism: An Exposition of the Theory of Natural Selection, with Some of its Applications. By ALFRED RUSSEL WALLACE, LL.D. London and New York, Macmillan. 12°. $1.75.

DARWIN, in the greatness of his unselfish candor, receded somewhat from the claims of his theory of natural selection, yielding to certain adverse criticisms; and now Dr. Wallace, who had independently originated the same theory, shows anew his own magnanimity in coming to the rescue in a volume entitled "Darwinism." The book is opportune, and worthy of its distinguished author, who is a recognized authority. Addressing all intelligent readers, it surveys the whole subject, confining this for the most part, however, to Darwinism pure and simple, which, as given in the title of Darwin's first enunciation, is the "origin of species;" namely, from pre-existing species by natural selection. Dr. Wallace has the advantage of reviewing the subject "after nearly thirty years of discussion, with an abundance of new facts and the advocacy of many new and old theories," especially from the pens of noted investigators and leading evolutionists.

This limitation to evolution of species, in twelve of the fifteen chapters, avoids many perplexing questions, and gives simplicity and unity to the argument. The author regards the main proposition, in its application to existing or comparatively recent species, as all that can be proven, every thing beyond that lying in the region of probable conjecture. The difficulties, popular or scientific, relate chiefly to the origin of the larger divisions of the organic kingdom, the first development of complex organs, and the like. All this is too remote and too imperfectly recorded to be entirely solved; yet he believes that the generic and ordinal differences among plants and animals are of the same nature as those found in many groups of species, only greater in amount. As we rise to classes and sub-kingdoms, the difficulty is much increased, and we may reasonably doubt whether a radically distinct plan of structure is due to the action of the same laws that have developed species.

In the second chapter, on the struggle for existence, old and new facts are presented, ending with an ethical vindication of nature. In the third the variability of species is illustrated by statistical diagrams and otherwise, showing that it superabounds and offers always and everywhere material that is plentiful for natural selection, rather than slight and rare, thus obviating one of the common objections to transmutation of species. After discussing in further chapters the subjects of artificial and natural selection, and after meeting certain objections (the utility of all specific characters being especially asserted, with some qualification, and the swamping effects of intercrossing denied), the author treats of infertility of crosses, and sterility of hybrids, and opposes the "physiological selection" of Romanes. Going a step further than Darwin, he regards infertility as beneficial under certain circumstances, and increased by selection. Four chapters are given to color, exhibiting the author's well-known views as to its origin and its uses, re-enforced by Alfred Tylor's observations on structural decoration. Darwin's theory of sexual selection of the ornamental is rejected, there being, for example, no evidence, except to the contrary, "that slight variations in the color or plumes, in the way of increased intensity or complexity, are what determines the choice."

The concluding chapters consider geographical distribution; the geological evidences of evolution; certain fundamental problems of variation and heredity, with criticism of the recent speculations of Spencer, Cope, Karl Semper, and Geddes, referring particularly to the improved Lamarckian doctrine, lately revived, that acquired characters are inherited; and, finally, Darwinism applied to man.

The descent of man from some ancestor common to him and the anthropoids is advocated, but it is argued that the law of continuity does not require that the human mind has been developed by the same causes that account for man's physical structure. As the glacial age introduced into the earth's history a new cause, with new effects, so a new agency is needed to explain the appearance of the higher faculties, which are not necessities of our earthly existence, and "appear almost suddenly and in perfect development in the higher civilized races." A new cause manifested itself first in organic life, next in sensation and consciousness, and last in a rational and moral being; and these manifestations of life "probably depend on different degrees of spiritual influx." The Darwinian theory, carried to logical conclusion, does not, in the judgment of Dr. Wallace, oppose, but lends decided support to, the spiritual nature of man.

Such are the principal topics of interest. Others, as, for example, an offered solution of complex modes of cross-fertilization of plants, might be mentioned. A regret may be expressed, that, in treating of variability, the author has confined himself too much to variation in mere proportions of form and color; also, that, on the subject of habits and instincts, he has not taken into consideration the quickness and permanence of sense-association and of associated impulses in animals, remarkably illustrated, for instance, in the dog-and-goose incident from the *Revue Scientifique* lately given in our pages. But the work is as comprehensive as might be expected in view of its special purpose.

The Child and Child Nature. By the BARONESS MARENHOLTZ-BUELOW. Tr. by ALICE M. CHRISTIE. Syracuse, N.Y., C. W. Bardeen. 8°. $1.50.

THE object of this work is to explain and defend the system of education devised by Froebel, and especially the series of exercises and songs that he invented for mothers to use in training their children. The authoress is deeply impressed with the failings of humanity in the present age, and especially with its moral defects, and thinks that the only way to counteract them is by the reform of education. Froebel's system she believes to be the right one, and she has devoted many years to the work of propagating it. A considerable part of this book is taken up with an exposition of Froebel's peculiar philosophy, which we have always found repulsive, but which seems to have a strange attraction for some minds. Froebel's theory is that education must proceed according to the universal law of development, which is "the reconciliation of opposites," or "the law of balance." What this so-called law really is, it is hard to find out, though in one place we are told that "Newton calls the law in question the law of gravitation." Then we are treated to remarks about "the continuity and inter-connection of all things in the universe," and so forth; but what all this flummery has to do with the education of children we are unable to see. Being at last out of this quagmire, the authoress proceeds to explain the practical methods of teaching devised by Froebel, beginning with the kindergarten, but devoting most attention to the exercises designed for the use of mothers at home. In most of these exercises the child makes a kind of figure with his hands which is supposed to represent some natural or artificial object, and the mother then sings a song. The resemblance, however, between the figure made with the hands and the object it is said to represent is not apparent to us, while the songs as they appear in English are little better than nonsense. Besides these exercises, which are to be systematically practised, Froebel wished to place the young child under a mass of other regulations, and even to regulate and systematize the mother's caresses. What merit there may be in his devices, only actual trial can determine; but we should think that such artificial treatment at the very beginning of life must seriously hamper the natural and spontaneous development of the child. We are not surprised, therefore, to find the authoress remarking of the book in which this system is set forth — the "Mutter und Koserlieder" — that she has learned by repeated experience "that in no way is so much opposition to Froebel's system excited as by any endeavor to propagate this book." She, however, is enthusiastic in its favor, and those who wish to understand the system it advocates will find it elaborately set forth in her book.

AMONG THE PUBLISHERS.

AMONG the popular scientific articles to be published in *The Century* during the coming year will be reports of the latest studies and discoveries made at the Lick Observatory in California, furnished by Professor Holden. Professor Putnam of Harvard has written a series of papers for the same magazine on prehistoric America, in which he will give the result of his own explorations of caves, burial-places, village sites, etc. A detailed account of the strange earth-work known as the Serpent Mound of Adams County, O., will be printed, and the illustrations of some of the papers will include a number of terra-cotta figures of men and women in a style of modelling heretofore unknown in American prehistoric art.

— The Appletons have published "A First Book in American History," by Edward Eggleston, intended for beginners in historical study. It is really a series of biographies of men more or less prominent in American annals, beginning with Columbus and ending with Lincoln, the author believing that children cannot follow the political development of a nation understandingly, and that biography is for them the natural door into history. There is much truth in this view, and Mr. Eggleston has been pretty successful in carrying it into practice, the men whose lives he relates being not only leading actors in American history, but also representatives of American character. The style in which the stories are told is likely to interest children, and the numerous illustrations in the book add to its interest and instructiveness. There is, however, no attempt to connect the various lives recounted so as to make a continuous narrative, and the reader gets no idea of the course of American history as an organic whole. In short, the book is not history, but only an introduction to history, and as such it has considerable merit.

— "Pensions for All" is the title under which Gen. M. M. Trumbull will give a severe lashing to the treasury raiders, in the October *Popular Science Monthly*. The writer was a general in the civil war, and is anxious for the honor, as well as the due rewards, of the former soldiers, and he expresses the fervent wish that the "pension temptation" may not "change the character or diminish the fame of the Grand Army." Dr. M. Allen Starr will have an article on "The Old and the New Phrenology," showing, with the aid of illustrations, what has been definitely learned about the location of the various mental faculties in the brain, and how the errors of Gall and Spurzheim have been exposed. A lively picture of "Evolution as taught in a Theological Seminary" will be given by Rollo Ogden. The writer finds his material for criticism in the lectures on dogmatic theology given in the Union Theological Seminary. Professor J. Howard Gore will contribute an article on "Anthropology at Washington," describing the investigations of the customs and history of the Indians and Mound-Builders which are being made by the government scientific bureaus.

— It is not generally known that there was an American governor of Emin Bey's province in Africa, which has recently attracted so much attention, owing to Stanley's relief expedition. Colonel H. G. Prout, who is now editor of the *Railroad Gazette*, was the immediate successor of General Gordon as governor of the Equatorial Province, and was one of his most trusted friends. It is announced that in the November *Scribner* Colonel Prout will fully describe Emin Bey's province, and will give many interesting recollections of General Gordon, with extracts from some unique private correspondence, and with a number of facsimiles of Gordon's letters and maps.

— The Rev. A. K. Glover will shortly publish a small volume entitled "The Jews of the Far East, or the Jews of the Extreme Eastern Diaspora," with the original Chinese texts of the inscriptions discovered at Kaifung-tu.

— D. C. Heath & Co. will publish in September, a translation of "Lindner's Empirical Psychology," by Charles DeGarmo, Ph.D., of the Illinois State Normal University. As the name implies, it is based on common experience rather than on metaphysical theories. It is written from the Herbartian standpoint, and is of interest from the light it throws on the science of teaching. The common complaint is that our ordinary abstract and verbal systems of psy-

chology appear to have only a remote bearing upon the business of teaching. The same firm publishes Sept. 20, "Sept Grand Auteurs du XIXe Siècle: Lamartine, Hugo, de Vigny, de Musset, Theophile Gautier, Merimee, Coppee, An Introduction to Nineteenth Century French Literature," by Alcée Fortier, professor of French, Tulane University of Louisiana. This book consists of a series of lectures, written for students, and forms a superior French reader, giving an account of the lives and writings of seven great French authors.

— The *New England Magazine*, an illustrated monthly, will be published at once in Boston, under the control of Dr. E. E. Hale and Edwin D. Mead. While largely devoted to the past of New England, the articles will not be confined to local topics. Short biographies of Parnell and Gladstone, papers on the French settlements in America, remarkable cities in New England, and fiction in prose and verse, are among the attractions promised during the first year.

— Joseph Thomson, who made the remarkable journey across Masai-land, in Africa, says in *Scribner's* for October: "It is my belief that if Stanley had taken this route [across Masai-land] those disastrous losses in men and goods which befell him would have been avoided, work would have been done in half the time, and a practicable route would have been opened,— an all-important work still to be done, and which must yet be done if the great work commenced by Sir Samuel Baker, carried on by Gen. Gordon, and solidified and extended by Emin Pacha, is not to be sacrificed, and the people once more given up to all the horrors of the slave trade." In the same number Professor N. S. Shaler of Harvard, after a careful consideration of the much neglected condition of the common roads in this country, makes the following suggestions: "I would in the first place suggest that in the Federal Department of Agriculture there should be a commissioner of roads, having at his command sufficient means to prepare and print as public documents accounts of the condition of roadways in this country, with essays on the method of their construction. Each State should likewise have a commissioner of public ways, whose duty should be to advance education in this class of questions in every possible manner. To him the town and county road commissioners should be required to report. He should cause to be constructed a map showing the location and condition of all the roadways in the State. These ways he should classify as regards their condition. Our country folk wallow in the mire of their ways, pay excessive tolls, endure, in a word, a grinding taxation, generation after generation, without appreciating the burden which rests upon them." Professor Charles Sprague Smith of Columbia College will give, in the same number of the magazine, the result of his observations on the present condition of the Icelanders. He made an interesting journey to Iceland in the summer of 1888, during which time he resided with the dean of a diocese near Reykjavik, and made with him an interesting journey into the interior of the island.

— The *Political Science Quarterly* for September has an article on "Italian Immigration," which is of some importance at the present time. The author, Eugene Schuyler, has resided in Italy for three years past, and speaks from some personal acquaintance with the Italian people. The emigrants from Italy in 1888 numbered nearly two hundred thousand, of whom a large proportion came to the United States. Mr. Schuyler discusses the causes of the emigration, the chief of which is the difficulty of getting a living, and as to the character of the emigrants themselves expresses himself favorably. He admits that they are very illiterate, but thinks that they will prove a thrifty class and of good morals too. Another paper of some importance is by W. T. Moppin on "Farm Mortgages and the Small Farmer." Some writers, noticing the increase in farm mortgages in this country, have expressed the fear that the land was passing out of the hands of the small proprietors, who would eventually become an extinct class. Mr. Moppin combats this view, maintaining that the debts are incurred in order to make improvements on the farms or to stock new farms, and that they are in the end beneficial to the farmers. Mr. Clarence Deming treats of "Town Rule in Connecticut," showing the inequalities of representation in the legislature, the little town of Union, for instance, with only 118 voters, having as many representatives as New Haven with nearly 18,000 voters. Besides these articles the *Quarterly* has the first instalment of an essay on "English Legal History," treating of the methods and materials of such history, and articles on "James E. Thorold Rogers," by W. J. Ashley, and on "Railroad Indemnity Lands," by Fred. Perry Powers.

— Ginn & Co. announce for publication "The Method of Least Squares," by G. C. Comstock, professor of astronomy in the University of Wisconsin, and director of the Washburn Observatory. This work contains a presentation of the methods of treating observed numerical data which are in use among astronomers, physicists, and engineers. It has been written for the student, and presupposes only such mathematical attainments as are usually possessed by those who have completed the first two years of the curriculum of any of our better schools of science or engineering. The principle of least squares is derived from the observed distribution of residuals in certain typical series of observations, and not from an assumed law of the causes of error, thus diminishing the mathematical difficulties usually encountered at the threshold of the subject. Especial care has been taken to apply all of the leading principles of the method to numerical data selected from published observations, and to give the computations in full, so that they may serve the inexperienced computer as models. It has been the author's purpose to so present the subject that a working knowledge of the method based upon an appreciation of its principles may be acquired with a moderate expenditure of time and labor.

— A book that is sure of a sympathetic audience is "Dante Gabriel Rossetti as Designer and Writer," by his brother William M. Rossetti, including a prose paraphrase of "The House of Life," which Cassell & Co. announce. The present is the only volume that William M. Rossetti has issued regarding his famous brother, though he has kept his memory green by several contributions to the magazines, one of them on the "Portraits of Rossetti," published in the *Magazine of Art*. In this volume the author has not attempted to write a biographical or critical account of Dante Rossetti. "Mine is a book of memoranda and of details," he says. A portrait of the poet at the age of thirty-five accompanies the book.

— On Saturday, Aug. 17, President Carnot received at a private audience in the Palais de l'Elysée, Paris, Dr. R. H. Thurston, director of Sibly College, Cornell University. Dr. Thurston has made a translation into English of the celebrated work of Sadi-Carnot, the great-uncle of the president, "Réflexions sur la Puissance Motrice du Feu," — a work which had never before been translated into English, but which has become famous throughout the world as the basis of the whole structure of the modern science of thermodynamics. Published in 1824, it was comparatively unknown, until Sir William Thomson, the distinguished British *savant*, called attention to its enormous importance; and its author has thus become famous as the greatest genius which has appeared in that department of science during the nineteenth century. The president of the republic kindly consented that Dr. Thurston should dedicate to him his translation of this great work. The following is the very elegant phraseology which Dr. Thurston proposes to give to this dedication: "Dedicated to Sadi-Carnot, president of the French Republic, that distinguished member of the engineering profession whose whole life has been an honor to the profession and to his country, and who, elevated to the highest office within the gift of the French nation, has proven, by the quiet dignity and the efficiency with which he has performed his august duties, that he is a worthy member of his own noble family, already rendered famous by an earlier Sadi-Carnot, now immortal in the annals of science, and has shown himself deserving of enrolment in the list of great men, which includes that other distinguished engineer, our own first President, George Washington."

— Retail grocers, and other retail dealers doing a credit business, are adopting a plan that is at once novel and decidedly useful. They issue to their customers coupon books similar to mileage books for railways, but instead of the coupons being for one mile, they are for one cent each; the value of the books varying from two to twenty dollars. These coupons are good for their face value in groceries or other merchandise at the store of the firm issuing them. When the books are issued, the dealer charges

his customer with the value of the book. When pay-day comes the customer pays this amount, and meantime uses the coupons for the purchase of supplies, the same as paying cash, thus avoiding all disputed accounts and saving valuable time to both the dealer and his customer. They are manufactured by the Historical Publishing Company, of Dayton, Ohio.

— The October issue of *The Chautauquan* is the initial number of Vol. X., and appears in a new form and with a cover of new design. It presents the following in the table of contents: "The Politics Which Made and Unmade Rome," by President C. K. Adams, of Cornell University; "The Life of the Romans," by Principal James Donaldson, of the University of St. Andrews, Scotland; Macaulay's "Lays of Ancient Rome," paraphrased by Arlo Bates; "Map Quiz" on *The Chautauquan* Map Series; "The Study of the Seasons," by Professor N. S. Shaler, of Harvard University; "Child Labor and Some of its Results," by Helen Campbell; "Mental Philosophy," by John Habberton; "The Uses of Mathematics," by Professor A. S. Hardy, Ph.D., of Dartmouth College; "The Burial of Rome," by Rodolfo Lanciani, of the University of Rome. Professor La Roy F. Griffin explains the general principles of "Explosions and Exposives"; "Canada and Ireland: A Political Parallel," is discussed by Professor J. P. Mahaffy of Dublin University; "The Future Indian School System" is an article full of practical suggestions for improving Indian schools, by Elaine Goodale; Hon. S. G. W. Benjamin, ex-minister to Persia, writes entertainingly of "The Women of Persia"; Bishop J. F. Hurst tells much that is interesting about "The Current Literature of India"; "Impressions Made by the Paris Exposition" is a timely article, translated from the *Revue des Deux Mondes*. The list of contributed articles ends with the Rev. J. G. Wood's observations of "Some Odd Fishes."

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The editor will be glad to publish any queries consonant with the character of the journal.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

Methods of Burial.

THERE is one method of preserving the body that is well worthy of notice, and that has not received the attention that its importance demands. It is the desiccation of the remains, considered in a report on the disposal of the dead, by John M. Peacocke, M.D., presented to the Medical Society of the county of Kings, Brooklyn. Long before the Spanish conquest, the Peruvians were adepts in this mode of preserving the dead. The bodies of the Incas, and their queens and countless numbers of their subjects, testify to this. The interesting question is often asked whether the ancient Peruvians embalmed their corpses, or whether the bodies owe their good preservation to the influence of the climate, which is so conducive to mummification. Señor Rivero, the director of the National Museum at Lima, having examined hundreds of mummies, was unable to find any preservative substance in them. It is true that in the skulls a brown or blackish mass, in dust or small pieces, has been found; but a chemical and microscopical analysis has proved that the dust and the pieces were composed of cerebral fat and globules of dried blood. All the mummies contain the brain and intestines, and in none of them could Rivero discover any incision which would have been necessary for evisceration had the bodies been subject to embalmment. In the mummy of a child found by Dr. Von Schudi, and which is now in the Imperial Academy of St. Petersburg, the ribs of the left side were detached from the sternum, exposing the thoracic and part of the abdominal cavities, plainly showing the heart, with the pericardium, the shrivelled lungs, the diaphragm, the transverse colon, and portion of the small intestines. These facts prove that the Peruvians did not have recourse in the preservation of the dead to any elaborate process of embalming as customary among the Egyptians. The bodies were simply desiccated by exposure to the air. The heated soil and calcined sand on the coast dried the corpse, and the pure cold air and dry winds of the interior did the same thing.

In Peru the animals that drop by the wayside will be found at the end of months entire, not corrupted, but dried. On the highway from Arequipa to Lima a number of the mummified animals are to be seen, which serve as landmarks to indicate the road when the wind covers it with sand. The climatic conditions of the imperial city of Cuzco are very favorable to the desiccating process. Here, in the great temple of the Sun, the remains of the Incas have been discovered in a marvellous and lifelike condition. Cuzco, the most ancient city of Peru, has an elevation of 11,380 feet above the sea. Surrounded by lofty and snowclad mountains, it might be supposed to possess a cold, not to say frigid, climate; but its temperature, though cool, is seldom freezing. In what is called the winter season, from May to November, the pastures and fields are dry and withered, more from drought than from frost.

La Casas describes the Peruvian burial rites as follows: "The dead are wrapped in the skin of the llama, then clothed and deposited in a sitting posture. The doors of the tombs, which are all toward the east, are then closed with stone or clay. At the end of a year, when the body becomes dry, the doors are again opened. There is no bad odor, because the skins in which the bodies are placed are sewn up very closely, and from the cold they soon become mummies."

Travellers in Africa have found bodies of camels, which had evidently died of fatigue in the desert, to be so dried and preserved by the heat of the sun that no evidences of post-mortem decay were discovered. The atmosphere of our North-west Territories is, in some places, so dry that the snows of winter pass off from the ground without leaving it wet, and mummified buffalo have been found on the plains of Colorado. When freshly killed meat is subjected to a dry summer heat, it is rapidly converted into the well-known *jerked beef* of the plains. Dried apples, peaches, and other fruits are familiar examples to every housekeeper of desiccated vegetable matter. This method of preservation is as widely known as it is primitive, and clearly indicates that absence of moisture prevents decomposition of organic material, or, in other words, desiccation takes the place of putrefaction. X.

New York, Sept. 16.

Monopolies and the People.

IN the criticism which you make (*Science*, xiv. p. 186) of the plan which I proposed for settling the railroad question, in my book "Monopolies and the People," I think you slightly misapprehend my views, as you say, "All fares and freight tariffs are to be fixed by the government commissioners." At the present time, in a number of the States of the Union, fares and freight tariffs *are* fixed by a State commission; and the provisions of the Interstate Commerce Law subject rates on all interstate traffic to the approval of the United States Government Commission.

My contention is that these rates should be fixed, not by a company, which holds a monopoly, or by a government commission, holding autocratic power. The one plan is unjust to the people; the other, to the railway-owners. The principle which seems to me the true one is, fix rates in proportion to the expense of carrying the traffic.

CHARLES WHITNEY BAKER.

New York, Sept. 14.

Queries.

48. ORIGIN OF THE COMMON NAME OF CROTALUS CERASTES. — Recently a naturalist friend residing in Santa Fé, N. Mex., begged to know of me the origin of the name "side-winder" for the horned rattlesnake (*C. cerastes*), and, although I have often heard that term applied to the crotaline species alluded to, I have never been able to ascertain how such a name came into use. The few persons versed in such lore to whom I have referred the matter could give no account of it, or state whether they knew of any particular habit of the horned rattler that would justify its being so called. Yarrow quotes the name in his "Check List of North American Reptilia and Batrachia" for the species in question, but, so far as I know, nowhere explains its origin; and I would be glad of any light upon this point.

R. W. SHUFELDT.

Takoma, D.C., Sept. 11.

Exchanges.

[Exchanges are inserted for subscribers free of charge. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

"I wish to exchange *Lepidoptera* with parties in the eastern and southern states. I will send western species for those found in other localities."—P. C. Truman, Volga, Brookings Co., Dakota.

Shells and curiosities for marine shells, curiosities or minerals address W. F. Lerch, No. 308 East Fourth St., Davenport, Iowa.

I want to correspond and exchange with a collector of beetles in Texas or Florida. — Wm. D. Richardson, P.O. Box 223, Fredericksburg, Virginia.

100 botanical specimens and analyses for exchange. Send list of those desired and those which can be furnished, and receive a similar list in return. Also cabinet specimens and curiosities for the same. Scientific correspondence solicited. — E. E. Bogue, Orwell, Ashta. County, O.

I will sell to chapters or individual members of the Agassiz Association, 25 fine specimens of fossil plants from the Dakota group (cretaceous), correctly named, for $2.50. Send post-office order to Charles H. Sternberg (author "Young Fossil-Hunters"), 1033 Kentucky Street, Lawrence, Kan.

One mounted single achromatic photographic lens for making 4 × 5 pictures, in excellent condition; also one "new model" double dry-plate holder (4" × 5"), for fine geological or mineralogical specimens, properly classified. — Charles E. Frick, 1019 West Lehigh Avenue, Philadelphia, Penn.

Drawings from nature — animals, birds, insects, and plants — to exchange for insects for cabinet; or I will send them in sets of ten each for ten cents in stamps. My drawings in botany are in detail, showing plant, leaves, flowers, seed, stamens, pistils, etc. — Alda M. Sharp, Gladbrook, Io.

The undersigned wishes to make arrangements for the exchange of *Lepidoptera* of eastern Pennsylvania for those from other localities. All my specimens are named and in good condition. — Charles S. Westcott, 613 North 17th Street, Philadelphia, Penn.

California onyx for minerals and coins not in my collection. — W C. Thompson, 612 East 141st Street, New York, N.Y.

A few first-class mounted birds, for first-class birds' eggs of any kind in sets. — J. P. Babbitt, secretary Chapter 755, 10 Hodges Avenue, Taunton, Mass.

Wants.

A YOUNG MAN can have lucrative engagement, not only a fixed salary, but according to his work accomplished in travelling for Science. A personal interview invited.
N. D. C. HODGES,
47 Lafayette Place, New York.

LIGHTNING. — Concise descriptions of the effects of lightning discharges are desired. State whether the object struck was provided with a lightning rod, the character of the rod, and the way in which it was set up. Beginning at the top, describe briefly the effects. State whether there was any smoke or dust raised, and whether there was any odor. Any reports of recent and of especially interesting discharges will be published in *Science*.—Science, 47 Lafayette Place, New York.